THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVI. No. 1949.] LONDON, SEPTEMBER 18, 1900. [52ND YEAR. PRICE 6d.

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Yield of Gas per Ton . 10,500 Cubic Feet.
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Coke . . . . . 68 per Cent.

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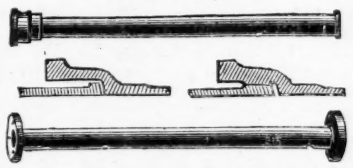
GAS AND WATER PIPES
1½ to 12 IN. BORE.



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For Particulars and Price apply to
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Prices and Analysis of all the Scotch Cannels on Application.

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"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
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THE "MELDRUM" FURNACE

At "The SHEFFIELD TELEGRAPH" Offices.

Reprinted from "The SHEFFIELD TELEGRAPH" June 27, 1900.

A SAVING IN FUEL OF £18 PER WEEK.

A couple of months ago when coal, which formerly cost us 8s. per ton rose to 12s. 6d., we read a lecture on the cost of steam production by John Holliday, in which the following paragraph appeared:—

Mr. Bryan Donkin, M.Inst.C.E., has published figures from some tests he carried out with different kinds of fuel in the same boiler, the conditions in all cases being the same; the results are comparable on the basis of the cost of fuel required to evaporate 1000 gallons.

Kind of Fuel.	Cost of Fuel per Ton.	Water Evaporated per Pound of Fuel.	Cost of Fuel per 1000 Gallons Evaporated.
	s. d.	lbs.	s. d.
A. Dust Coke	5 0	6	3 8
B. „ Welsh Coal . . .	10 0	8	5 3
C. Large „	22 0	9	10 11

Discovering that the Sheffield Gas Company made a considerable quantity of coke dust, which they gave away to builders and others, we entered into a contract for a supply for three years. Having a spare boiler, we had Meldrums' forced draught fitted, and soon discovered that coke dust made a very satiefactory fuel for steam raising. Our second boiler was then fitted, and we are now burning coke dust on the two almost exclusively. From an economical point of view, the experiment is very satisfactory, as will be seen from the following figures:—

Average week, Coal only, on One Boiler.

	£ s. d.
45 Tons at 12s. 6d.	28 2 6
Ashes at 2s., Seven Loads	14 0
	£28 16 6

Present Consumption on Two Boilers.

	£ s. d.
Six Tons of Coal at 9s. 3d.	2 15 6
Coke Dust	3 4 0
Two extra Stokers	2 12 0
Flues cleaning	10 0
Ashes, 12 Loads at 2s.	1 4 0
	£10 5 6

We shall be pleased to show the arrangement to anyone interested in the subject of the economical production of steam. There is no smoke from the chimney stack of the "Telegraph" Office, which is another good point in favour of coke dust as fuel.

Makers and Sole Proprietors: **MELDRUM BROTHERS, LTD.,**
Engineers, ATLANTIC WORKS, MANCHESTER.
LONDON OFFICES: 66, Victoria Street, Westminster. LEEDS OFFICES: 5, East Parade.
Telegrams: "MELDRUM" Manchester, London, or Leeds. National Telephone: Nos. 1674, Manchester; 193, Westminster 1391, Leeds.

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Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

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MANUFACTURERS OF **PURIFIERS** OF ALL SIZES,

With Improved Centre-Valves, to work either One, Two, Three, or Four Purifiers at one time.

SLIDE VALVES.

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"Some years ago you made an
"18-inch double covered valve for
"Purifiers delivered to our Works.
"We are likely to want another
"for this Station; how soon could
"you supply it, and what would
"the price be delivered here? The
"first one which you made for me,
"above 30 years ago, is still
"in excellent working
"order."

Hand-Power LIFTS, suitable for weights up to 10 Tons.

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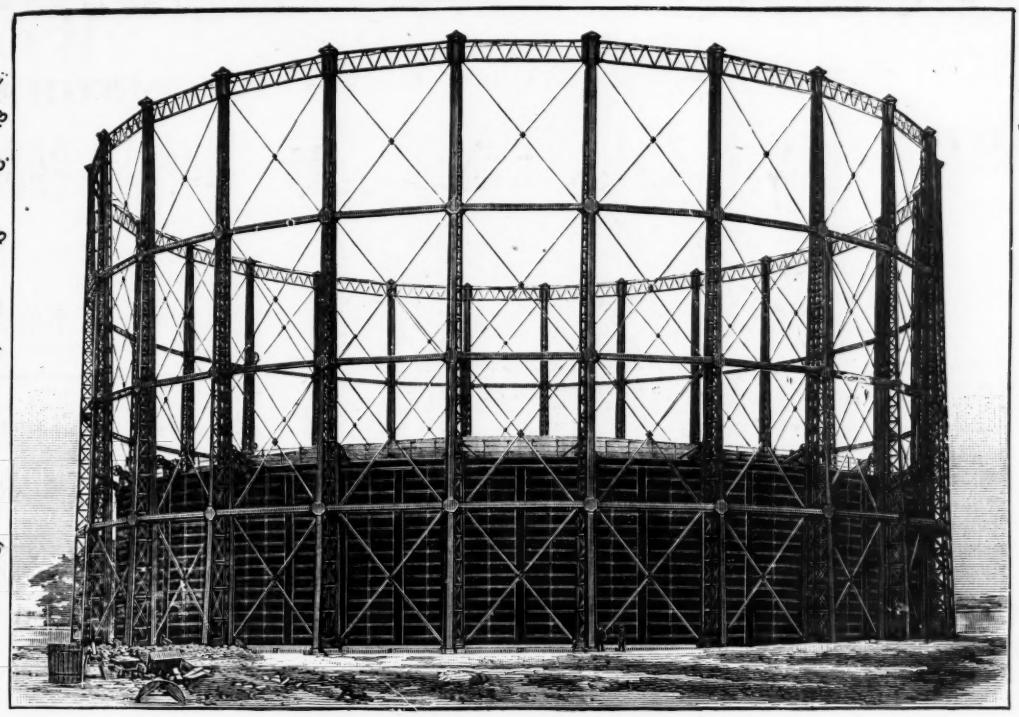

TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM.

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COVENTRY
WINCHESTER
SHANGHAI
STOCKPORT
NORWICH
LEA BRIDGE
DUNEDIN (N.Z.)
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EDINBURGH
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CROYDON
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COLNEY HATCH
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SYDNEY (Mortlake)
MAIDENHEAD
EPSOM
NORTH MIDDLESEX
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FALMOUTH
SOUTHAMPTON
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UTRECHT
DEVENTER
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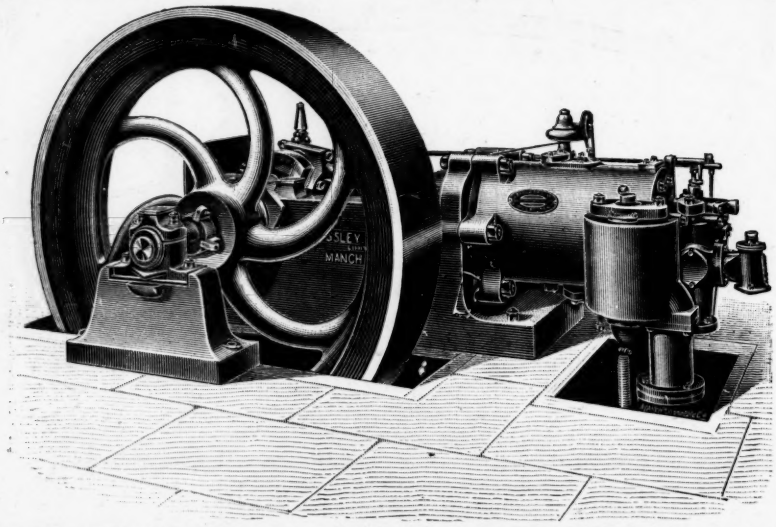

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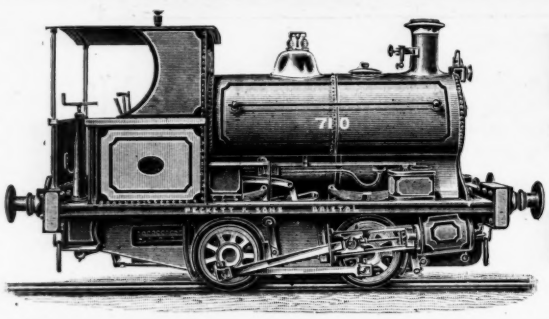

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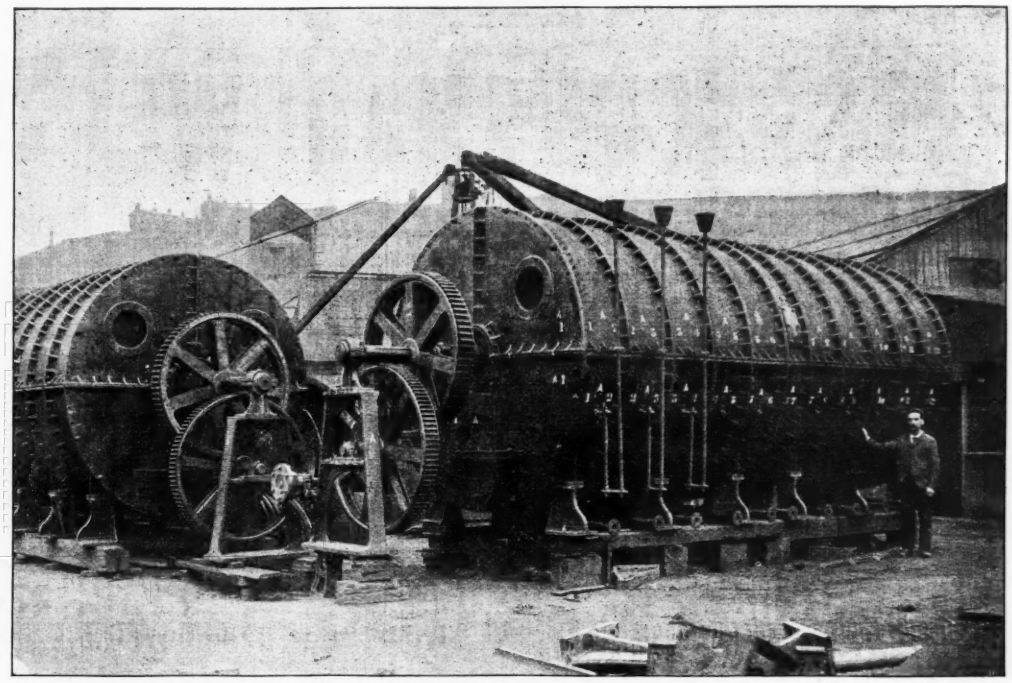
IN VERTICAL OR HORIZONTAL FORM.



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GLASGOW	1,250,000
Do. (Four Machines)	1,250,000
Do. (Four Machines)	2,000,000
Do. (Four Machines)	2,000,000
AMSTERDAM	2,000,000
BRYMBO	1,250,000
MORPETH	120,000
SHILDON	400,000
SUTTON-IN-ASHFIELD	200,000
CHATTERLEY	1,500,000
BROUGHTON-SOLVAY	1,250,000
Do. do.	1,000,000
KELSO	200,000
WISHAW	400,000
WIDNES (Two Machines)	1,000,000
Do. (Two Machines)	1,250,000
WOODSIDE (Two Machines)	400,000
Do. (Two Machines)	500,000
TODMORDEN	800,000
ABERDEEN	2,500,000
ECCLESHILL	250,000
LONGTON	1,000,000
PAISLEY (Vertical)	1,500,000
CARLTON IRON CO.	2,000,000
Do. do.	2,500,000
TALK-O-TH'-HILL	2,000,000
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SHETTLESTON	500,000
NANTWICH	250,000
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PADIHAM	500,000
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SEATON CAREW (Four Machines)	2,000,000
Do. do. (Four Machines)	2,500,000
Do. do. (Four Machines)	2,500,000
NORTH E. STEEL CO. (Four Machines)	1,000,000
Do. do. (Four Machines)	1,000,000
Do. do. (Four Machines)	1,250,000
Do. do. (Four Machines)	1,250,000
HURST MILLS	500,000
THRISLINGTON	1,000,000
Do.	1,250,000
SHERINGHAM	50,000
BRACKLEY COLLIERY	1,000,000
Do. do.	1,250,000
ORIENTAL GAS CO. (CALCUTTA)	1,250,000
BANGOR	1,000,000
CHATTERLEY (Vertical)	1,000,000
DUDLEY	750,000
Do.	750,000
PLEANE COLLIERY	800,000
AMBLESIDE	120,000
PRESCOT	200,000
LLANDUDNO	500,000
CORK	1,500,000
BIRMINGHAM	2,500,000
FARNWORTH	500,000
FALMOUTH	500,000
BIRMINGHAM	2,500,000
HARROGATE	1,000,000
HELENSBURGH	500,000
GARFORTH	50,000
MANCHESTER	3,500,000
WEST HARTLEPOOL	2,000,000
PAIGNTON	500,000
POCKLINGTON	50,000
STOURPORT	200,000
TROON	120,000
DUMBARTON (Vertical)	500,000
SALFORD	2,000,000
FALKIRK (Vertical)	1,000,000
STOKE ON-TRENT	1,000,000
BRACKLEY COLLIERY	1,000,000
Do. do.	1,250,000
CATERHAM	400,000
ILFORD	2,000,000
SEMET SOLVAY CO. (Six Machines)	3,000,000
Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
ROYAL ARSENAL (WOOLWICH)	2,000,000
ELLAND	1,000,000
NORMANTON	400,000
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BISHOP AUCKLAND	600,000
TYNEMOUTH	1,500,000
SELKIRK	500,000
BEVERLEY	500,000
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JERSEY (Extended) (Vertical)	250,000
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A Perfect Lantern for thoroughly Economical and Efficient Incandescent Gas Lighting.

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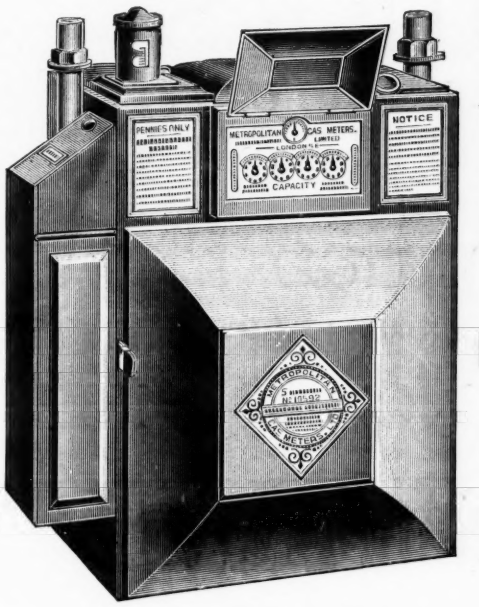

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PREPAYMENT GAS-METERS.

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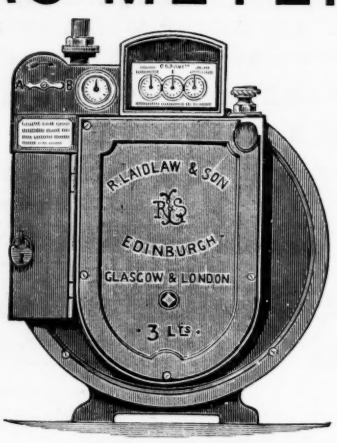

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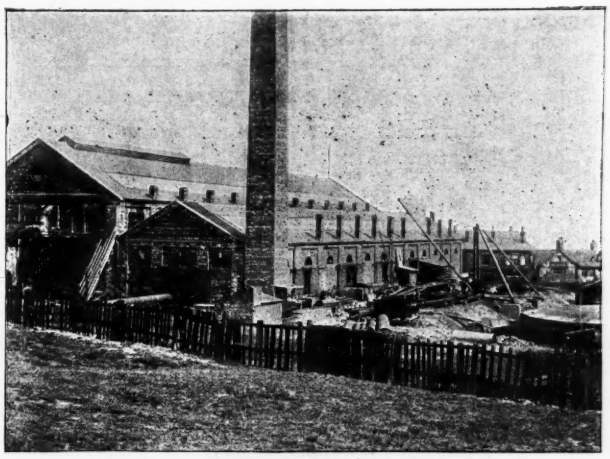

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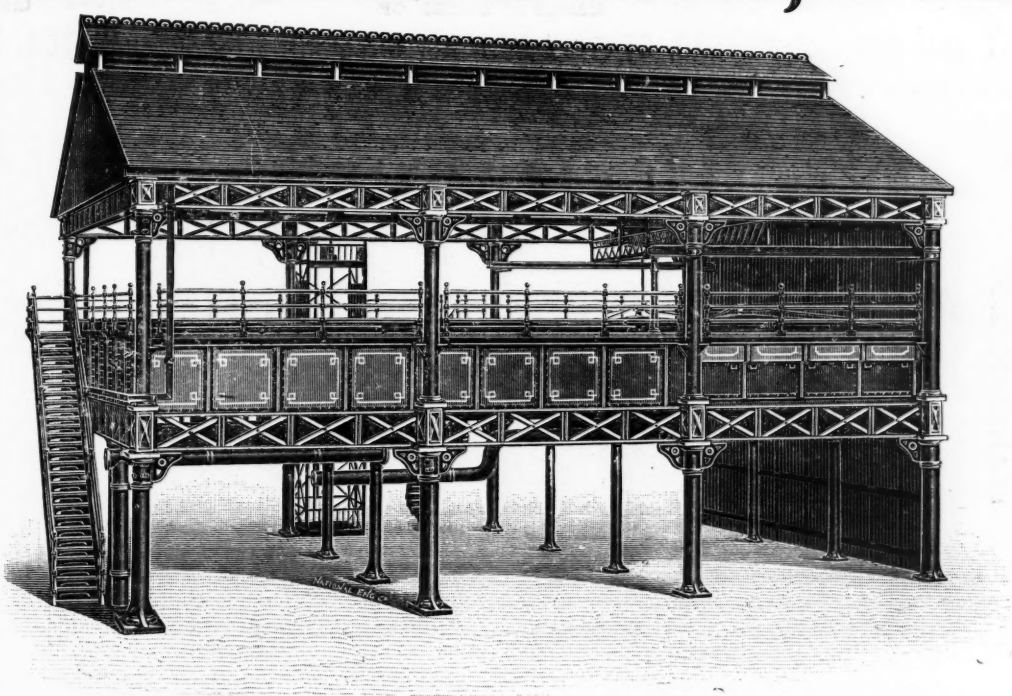

Telephone: No. 8 ELLAND.

View of Six Purifiers, Superstructure, Roof, &c., erected by R. Dempster & Sons, Ltd. (*From a Photo.*).

CONTRACTORS FOR EVERY DESCRIPTION OF GAS APPARATUS.

Carbonizing Plants a Speciality.

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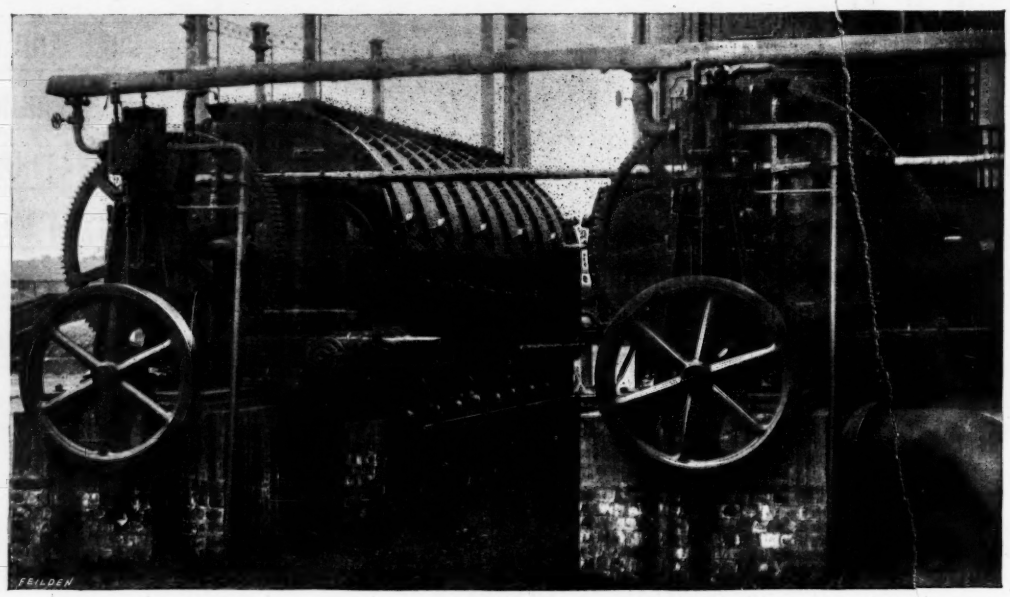

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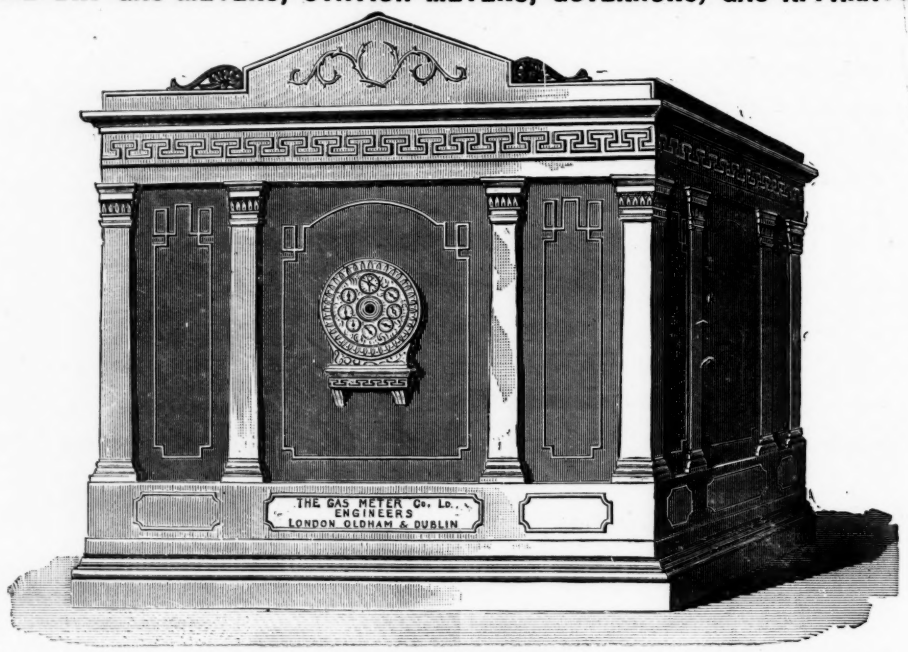

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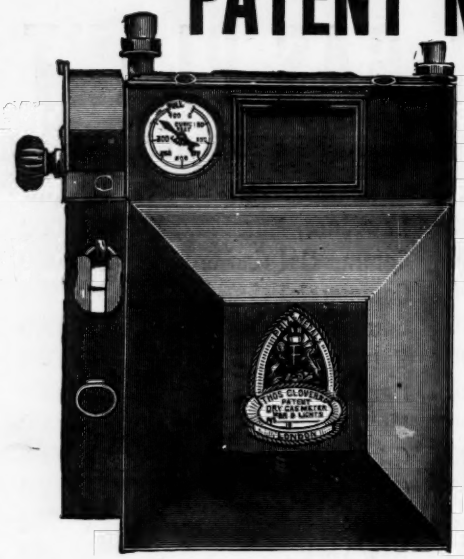

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EDITORIAL NOTES.

Mr. Forstall on Technological Education.

THE paper by Mr. A. E. Forstall, on the work carried on by the Trustees of the Gas Educational Fund connected with the American Gaslight Association, read before the International Gas Congress in Paris—the full text of which will be found to-day on p. 707—will recall to our readers, and amplifies, the summary of the first report of the Trustees, which was noticed in the "JOURNAL" for Nov. 21 last. The method adopted in America for the spread of technical education among the rising generation of gas workers—we use the term advisedly, as the opportunities afforded for self-improvement are by no means confined to staff officials—differs radically from that in vogue in England; and, as Mr. J. W. Helps said, in the course of the discussion on Mr. Forstall's paper, the American plan has much to commend it. The difference between the American and the English systems is, briefly, that the former provides for and supervises the education of every student, and holds no examinations, as we understand the word; while the latter is content with the holding of an annual examination, the granting of a few prizes, and the subsidizing of Polytechnics and such-like institutions, which, in all but the largest centres, means that the student receives no organized assistance or guidance in the pursuit of his studies.

We need not here explain the American system in detail. It consists, as our readers are aware, in education by correspondence; each member of the class being given twelve questions to answer every quarter, with leave to obtain the information necessary to their answering from any available source. Thus, the American student has forty-eight questions to answer in the course of the year, as against the eight which his English *confrère* has set him at the annual examination held by the City and Guilds of London; and the former must necessarily be able to give better proof of the thoroughness of his study, of his powers of forming and expressing opinions, and of his merits as a draughtsman, than can possibly be given in the scurry of answering eight fairly stiff questions in the course of a short three hours. If it be argued that the answering of questions by the aid of text-books, or after inquiry of those who know, is no test of a man's own fund of information, we would point out that the real end to be served is that of ensuring that the man eventually possesses the information; and that the seeking out of the facts, the consideration of all that is to be learnt in regard to them, their careful committal to paper, and the subsequent comments and advice of the examiner, are, in combination, even more likely to impress a knowledge and understanding of the subject firmly upon the mind of the student, than cramming for an examination may do.

It must be borne in mind that the American course of study covers three years; so that each member has to commit to writing full answers to 144 questions during his studentship. Although, as Mr. Forstall says, it is impossible to cover with that number of questions all the details of all the subjects upon which a gas engineer should be informed, the study and research necessary to the compilation of complete answers must obviously lead the student over the whole of the ground. Indeed, we should be inclined to attach considerably more value to a certificate which implied that the member to whom it was granted had been closely and successfully applying himself for three years to the work involved in answering these questions, than to one which might only mean that the examinee had done six months' cramming. Mr. Forstall speaking for the American Trustees, and Mr. Charles Hunt as a former Examiner for the City and Guilds of London, each declared that the questions set under the system he represented dealt with practice as well as theory. Indeed, Mr. Hunt went so far as to say that "the questions were "invariably put to test their practical knowledge." Now, as readers of these columns will know, that is a point upon which we cannot altogether agree with Mr. Hunt; for we have previously expressed the opinion—to which we adhere—that success in the examination held by the City and Guilds of London Institute does not at all necessarily imply the possession of practical knowledge by the student. As an ounce of fact is worth a pound of opinion, we may state, in support of our view, that we know of one student at least who has been awarded a medal by the Institute for his success in the "Gas Manufacture" examination who had

never previously set foot inside a gas-works, a laboratory, or even a draughtsman's office.

We say this, not because we wish to depreciate the value of the certificates granted by the South Kensington Institute, but because we want, on the contrary, to enhance their value by inducing those responsible for the conduct of the examinations to make the papers include questions bearing upon the practical difficulties that everyone concerned in the actual management of a gas-works must at some time or another encounter; to give marks of distinction to candidates showing special practical ability; and, further, to see that sufficient time is devoted to the examinations to enable the students to answer the questions carefully and adequately. The opinion expressed by more than one speaker in the debate which followed the reading of Mr. Forstall's interesting paper—that more value would be attached to certificates granted by the Institution of Gas Engineers or the Gas Institute than to those granted by any examining body not connected with the profession—is worth the careful attention of those corporations. They might also, with advantage, consider whether it would not be possible and wise to undertake more than they at present do for the advancement of technical and scientific training among the workers in the industry, either on the lines of the American plan or on others that might be deemed more suited to the needs of English students.

Questions of Gas Poisoning.

Last Thursday a fatality, ascribed in the first reports to gas poisoning, was discovered in a small house in Tottenham. According to the newspaper account, it was 3 o'clock in the afternoon before anyone opened the house door, and then the interior was pervaded by a strong smell of gas. Upstairs in the front room of the cottage the householder, an artisan, was found lying dead on the floor, and his wife unconscious in the bed. A "glimmer of gas" was burning in the room. In the back bedroom a lad of seventeen lay dead in bed. The wife and another son, not dead, but unconscious, were at once removed to the hospital. Friday's "Daily News," from which this very clear narrative is taken, concludes the report of the occurrence with the statement that "the source of the gas escape had not been "discovered last night, when the premises were locked up "and taken charge of by the police." We have taken measures to procure authentic information concerning this deplorable casualty. The Birmingham gas poisoning case, reported in last week's "Journal," furnishes the current number of the "Lancet" with the text for a homily upon the danger of water-slide gas-pendants; and our medical contemporary, while not going so far as to say that this description of fitting should be made illegal, lays it down that no prudent householder should put one of them into his house. With this piece of good advice we unreservedly concur.

The water-slide gas-pendant, like "compo." gas tubing, is but a survival from an age of less perfect mechanical equipment than the present enjoys. Possibly few people now living have ever seen the water-joint gas-bracket, which was at one time as common as the so-called "hydraulic" pendant, and must have been as much more dangerous as the water-seal was shallower. Most people, at any rate, can easily recall the recent days when a glittering lacquered brass sliding "chandelier," with any desired number of branches, was an article of genteel furnishing that no respectable householder could dispense with. The pattern books of gas-fittings manufacturers of that period showed many such, in an embarrassing richness of apparent variety which vanished as soon as the expensive luxury was duly fixed in its place. One pendant had a way of looking very like another after a short period of service. Still, a patient, not very artistic public went on buying these costly abominations; and we are credibly informed that there is still some demand for the less pretentious patterns of the article. Happily, however, the public taste has changed in this regard. A severe simplicity, not exclusive of some daintiness, rules the present-day fashion in lamps of all kinds. No longer will the suburban resident cheerfully pay £10 for a bright brass chandelier. The regenerative gas-lamps first ousted these monstrosities of the brass-finishers' art from their pride of place over the dining-room table. The "stuffiness" of atmosphere produced by five or seven flaring flat flames, barely visible through the thickly-frosted globes, was undeniable. So in many instances at some Spring cleaning time, when the workmen were in the house, the old chandelier went its way to the scrap-heap; and a single ventilating and perhaps regenerative gas-lamp shone steadily in its place.

The supposititious advantage of being able to vary the height of the light above the table, which was the sole excuse for the water-slide as of its humbler congener, the cork-slide pendant, has been given up in the majority of instances without causing any notable inconvenience. A more intelligent fashion of distributing lights in interiors, according to the most customary requirements of everyday-use, has done away with that senseless massing of light in the centre of every apartment of which the pendant was the symbol. There are better means, besides, of providing for a concentrated or adjustable light such as will always be required for special purposes. The man who has much close reading or hard writing to do, or the housewife who wishes to do "black work" by night, can and should be suited with special lights appropriate to the position and the purpose, and should be better advised of what is good for their eyes than remain content with a share of the general lighting which is nevertheless ample for ordinary purposes.

One is glad to notice that the "Lancet" does not commit the banality of crying out against the progressive use of carburetted water gas on those "sanitary grounds" which seem to bulk largely in the professional minds of the doctors of Darlington, as we reported last week. Rather does our medical contemporary incline to the reasonable view that the increase of the proportion of carbon monoxide in town's gas, due to the forced recourse of the manufacturers in many cases to auxiliary carburetted water-gas plant, is something to be taken note of, not in an alarmist way, but as strengthening the protest against the continued use of dangerous gas-fittings. "It must be remembered that coal "gas is poisonous under any circumstances; and that "being so, care must be enjoined in its use." This is the correct way to state the case. The use of town's gas is increasing so fast, and spreading so widely among the poorer and less educated grades of the community, that accidents must be expected now and again. The circumstance that the users of prepayment gas-meters have their fittings put in by the gas company is an effectual protection against any mishap attributable to flimsiness of material, unsafe design, or fraudulent workmanship on the part of some local fitter.

Curiously enough, the risk of carbonic oxide poisoning, from laundry stoves used for drying clothes, is the subject of a long report in last week's "Lancet," by Dr. C. R. Elgood, of Windsor. Two women, engaged in a workhouse laundry, were overcome with carbonic oxide escaping from a mismanaged and badly-constructed coke stove; and one died. The apparatus was of an old-fashioned square cast-iron pattern in common use for this purpose, having the dangerous peculiarity that the flue-hole was nearer the bottom than the top. This left plenty of room for piling up coke above the flue, which had evidently been done in this instance, so that there was nothing for it but the escape of the fumes into the room through the feeding-hole in the top of the stove. The surviving woman confessed to having made up the fire to an unauthorized degree, for the purpose of cooking potatoes on the lid of the stove. When the fatal room was entered the same evening, blue flames were seen coming out round the feeding-door in the top of the stove. Dr. Elgood, while sensibly concluding that it is unnecessary to look farther for the cause of this death, justly makes a few observations on the circumstances. As he says, one expects to find, when in the presence of a smothered coke-fire, certain unpleasant, and even acutely irritating consequences of the fact—such as a "gassy" smell, or smell of sulphur. In the present instance, there was nothing of the kind. Both carbonic acid and carbonic oxide probably escaped freely from the stove, although the statement that carbonic oxide was seen burning round the stove lid rather militates against the conclusion that much was escaping unburnt. The condition of the blood of the dead woman was indicative of the way of her death. The most valuable of Dr. Elgood's observations on this case are those referring to the curative treatment of victims of gassing by carbon monoxide. He objects to too prolonged a use of artificial respiration as being of more harm than good. A short, brisk treatment of this kind, with oxygen inhalation, and friction and slapping over the heart, does great service. Meanwhile, the

body should be kept warm by external means, and not unduly exposed to the air.

Is the British Association Getting Decrepit?

THE termination of the British Association meeting at Bradford, with a record of total attendance falling short of that at the previous meeting in the same town, in 1873, inspires some journalistic critics of the Association with the suspicion that the organization is "on the wane." This is precisely the thought that might be expected of a disciple of the modern creed which sets up the "counting "of noses" as the sole and sufficient measurement of the importance of a cause—except, of course, when the partisan happens to be in a minority. We have perused with some interest a lengthy newspaper article which undertakes to show that the British Association had better dispense with the support and countenance of the "nobility, gentry, and leaders of religious thought" whom Sir David Brewster thought to bring into union with men of science in 1831, when the Association was founded. It is suggested that the notable orders of the community of those days have lost their ancient importance; and therefore that "if the British Association is to "continue its career as a useful and honoured institution, "it must appeal to those classes who now form the back-"bone of our nation—namely, to the manufacturers and to "the artisans of our country." Funnily enough, the same article immediately goes on to inquire how many of the Bradford manufacturers attended the Association meetings, and alleges that in all probability the artisans of the town looked at their newspapers all the week more for the football and racing news than for the doings of the Association in their midst. True enough, most likely; but one fails to see in this circumstance proof of the existence of "ample "scope for effort on the part of the Association to enlist the "sympathy of these classes in its work." This, surely, is preparatory work. The British Association is no elementary school, nor is it a system of evening continuation classes. If the workpeople of Bradford care more for betting, football, and "week-ending" than for the transactions of the British Association, whose fault is it? The implied sneer at the Bradford manufacturers who did not press in overwhelming numbers into the Association meetings is a miss-fire. Business is their science; as science is the business of the Association. If the prestige of the Association has suffered at all of late years—which we are not prepared to deny—it has not been by reason of too close an adherence to true science, but to too great laxity in admitting the popular, the commercial, and the self-advertising elements into its transactions. A ruthless critic "in the know" can usually mark off a large proportion of papers and appearances with the significant affix "(advt.)." The most pressing temptation of the Age for scientific men is to turn everything into shekels; and the British Association is to be revered in the measure in which its henchmen resist this pressure. The interest of the manufacturer, whether of Bradford or elsewhere, in abstract science is merely that of any other citizen of his grade—no more, no less. But as for the artisan, whose choice reading is of football and racing, why should Science bow to his tastes? Are these not already intrusive enough, in other places? Is not almost every newspaper published for him? Are not the problems of housing him, supplying him with the drink his soul loveth, providing him with the titillation of a threatened strike, ever and always with us? If the British Association could only promise tired people a glimpse of the eternal verities, regardless of all the "causes," and all the "interests" that run everything in this sublunary world, from churches to newspapers, it would earn the gratitude of a worried generation, which may no longer worship Royal Dukes, but has no inclination to bow down before a Trade Union secretary as a sort of fetish.

The Gas Affairs of Sheffield—Incandescent Gas Lighting in the Ascendant.

THE ordinary half-yearly meeting of the Sheffield United Gas Company was held last Tuesday, under the presidency of Sir Frederick T. Mappin, who improved the occasion, as usual, by giving the people of Sheffield a full and particular account of their gas affairs. It cannot be too widely known that Sheffield is one of the relics of the old maximum dividend settlement, and abundantly justifies this simple plan. Mr. Livesey is accustomed to say that this settlement, which is represented by the Gas-Works Clauses Act, 1847, was all very well while there was competition in gas supply; but that with the advent of districting, it fell out of joint. In the Sheffield case, the useful office of competition is performed by several substitutes. One is the peculiar publicity of the affairs of the Company secured by the presence on the Board of Nominee Directors belonging to the Corporation. Another is the effective rivalry between Sheffield and neighbouring manufacturing towns. Sir F. Mappin is always frank and chatty to a degree; but he surpassed himself this time. He ranged over all the points of technical interest of the day, from incandescent gas lighting and the prospects of cheapened "light gas" manufacture, to the Westinghouse gas-engine. We are glad to learn that the Sheffield Company have adopted the system of installing and keeping up incandescent gas-burners. It will be valuable to hear later how this has answered. Gas managers throughout the South of England and the Midlands will smile at the announcement that Sheffield has discovered the remedy for naphthalene. An inquiry by a proprietor elicited the interesting fact of there being already 30,000 2-light meters in use in Sheffield, which render unnecessary anything like automatic prepayment supplies. These consumers, of course, escape the usual surcharge on the automatic deliveries; and the profit made by the Company out of them must be very little. These are the same class of people who go in so strongly for incandescent lighting in Germany, because they cannot afford to use flat-flame burners at German gas prices. Sheffield, in fact, beats Germany easily, since here a Welsbach burner consuming 4 cubic feet of gas per hour (which is unnecessarily large), gives ten hours of the most brilliant home light in the world for 1d. It is no wonder that the Sheffield Corporation are going to light the sewage works with their electricity. There will be small demand for it in the town.

Lighting Affairs at Hastings.

THE condition of the gas and electric light undertakings at Hastings is a sore point with local politicians who have burdened the ratepayers with an electricity supply business which does not pay, and are wroth at the prosperity of the Gas Company. Hastings is a typical South-Coast pleasure town, with absolutely no local industry except that of letting lodgings. It is also one of those ancient towns which still keeps up a local coal duty; and this piece of indirect taxation pleases nobody. The economy of such a place is likely to prove a curious study for anybody accustomed to live in a town of a totally different character. The first piece of information which a visitor to Hastings who might also happen to be a gas manager would esteem as reassuring, is that the gas consumption of the district has increased by about 10½ per cent. for the year. There is likewise a familiar sound about the statement that the price of gas has had to be raised. In his interesting speech at the recent half-yearly meeting of the Company, the Chairman (Dr. Gray) mentioned a circumstance in connection with the rivalry of the Corporation Electric Lighting Department with the Company which does not redound to the credit of municipal trading as practised here. It appears that public lighting is the mainstay of the electricity undertaking, and is being done at less than cost price, so as to hoodwink the ratepayers—the balance being paid out of the rates. It is the policy of the Corporation to push the public electric lighting as much as they can, and so make what can be advertised as an increasing business for the Electric Lighting Department. Accordingly, they have served notices upon the Gas Company to discontinue a number of public lamps, as they are about to be replaced by electricity, which means that the Gas Company, who are bound to provide the standards and lanterns as and when required, must return these goods into store and wipe off the original cost. As the Chairman of the Company very aptly remarked, if the Corporation were so served in their turn, there would be a great outcry; but such is municipal life. We mention this Hastings experience both for its illustrative value, and also because we recently had something to say about the unsatisfactory character of the Corporation electric light finance. The Gas Company are under the sliding-scale, so that the necessity for increasing the price of gas will affect the shareholders, who get little over 5 per cent. on the value of their investment. The apologists for the Corporation in the Press call this a "bloated dividend," whereas the Corporation need 7 per cent. to pay interest and redemption charges on their electric

light loans, to say nothing about depreciation. Yet we suppose that wherever the subject is publicly mentioned, the enterprise of the Hastings Corporation is cited as a shining example of the glories of municipal trading.

Waverley Association of Gas Managers.

In matters pertaining to history, the popular mind runs upon jubilees, and even, in later years, impatient of progress, upon semi-jubilees. But there is, to thinkers of a more solid turn of mind, a deeper charm in the forty years' period of existence. Bringing the subject home to ourselves, it is forty years now since gas managers began to associate together, for purposes of mutual protection. The Waverley Association of Gas Managers held their seventy-ninth half-yearly meeting at Dalkeith on Thursday last. Assuredly, in their case, the past forty years have not been a wandering in the wilderness, but the reverse; and the same may be said of the gas industry generally. Confining our remarks to the Waverley Association, it has to be noted that the district in which its members live has undergone little material change since the Association was originated. Probably as much change is to be found within the industry itself as in any of the other common pursuits of mankind in the locality. It was a threatened industry forty years ago—threatened by the tirades of the bombastic Flintoff, and indeed the Association owes its existence to that fact. During the period which has elapsed, the spirit of combination has never flagged, but has grown both in extent and in strength of purpose. Without having accomplished great things, the industry in the Waverley district is at the present day more powerful for the fulfilment of its mission than it ever has been. If it is not free from threatening surroundings at this time, it is better able to meet them.

Undoubtedly the ground is changing for the Waverley members in more ways than one. We do not refer to the state of affairs generally, which are well known, and which are not without their effect upon the fate of Waverley gas undertakings. But hitherto the managers of these works have lived in the hub of British gas making. The cannel which made Scotch gas the best product of its kind, was found in their very midst. Theirs was the citadel of gas making; but this cannot be said of it now. Other modes of enrichment have come to the front; and the Waverley members, instead of having something to teach, are passing into the position of requiring to learn. It will be a satisfaction to them to know, on the authority of Mr. J. A. Hood, the General Manager of the Lothian Coal Company, that there is no risk of their rich coal deposits giving out as yet. So that, if the members have now, more than ever, to learn things which they could heretofore ignore, they are not under any necessity to unlearn anything which they have hitherto held to be of the essentials of gas manufacture. The probability is, therefore, that for many years to come, there will be a distinctive characteristic attaching to gas management in the Borders of Scotland; and while that is so, if for no other reason, the need for the existence of the Waverley Association of Gas Managers will continue.

The meeting on Thursday last was a happy one. The absent President—Mr. W. M'Giffen, of Huntly, and late of Earlston—sent an address which suggested much debateable matter, and the members gave freely their experiences, in the homely conversational style which prevails in the Association, upon subjects which are of perennial interest to gas-works managers. After this very successful meeting followed a more than usually interesting excursion, which included a descent into the bowels of the earth, to the very source of the gas supply—the coal face. It is seldom that so much useful work can be crowded into one day by any body of technical workers.

The Great Eastern Railway Men's Agitation.

When the statesman of a past generation made the historical observation "We must educate our masters," he unfortunately forgot the preliminary necessity for educating the teachers. Many of our social troubles of to-day seem to be traceable to the same old source and origin of evil—ignorance; but this is not due to any lack of teachers, in and out of school. We are moved to offer this remark by the reports in yesterday's papers of the latest phase of the Great Eastern railway men's agitation. The Board of the Company, having gone into the men's demands for a general advance of wages and other concessions, formulated in reply a scheme dealing with the question of wages by classes, and making definite ameliorations of the employment in certain particulars. This scheme was considered last week by a meeting of the men's delegates; and a "mass meeting" of the employees affected was held on Sunday, to say whether the men would accept it or determine to strike for more. Many speeches, more or less to the point, were made at this meeting; and the upshot of it was the carrying of a resolution in favour of handing over the dispute to the Executive of the Amalgamated Society of Railway Servants. Even the "Daily News" interprets this as agreeing to take what is offered and go on asking for more. There will be no strike. Very artlessly, the newspapers report that Mr. Richard Bell, the Secretary of the Society, happened to be present at the meeting "as a "looker-on." He "jestingly remarked that he did not know "whether he should be 'chucked out' or not." Instead, he was asked to make a speech, and did so; expressing the hope that every railway man who did not belong to the Society would forthwith become a member, and obey the orders of the Executive, whatever these might be. He also indicated that he was in favour of an Act being passed in the new Parliament for compulsory arbitration in labour disputes. Most opportune was Mr. Bell's presence on this occasion; for, of course, it was no "put-up job," as he would probably call it. But the point of our initial sentence is here: This Trade Union official is in his way a product of the period which has passed since the schoolmaster was sent abroad by a supposed liberalizing Act of Parliament. So is the newspaper writer who yesterday backed him up with the statement that "compulsory arbitration has been "brilliantly successful in Australasia," and proceeded to ask why it should not be equally successful in the Old Country. More "flapdoodle!" Are parliamentary candidates at the coming General Election to be dosed with it? If so, they had better make an early note of the facts of the matter to which we briefly drew attention last week. If any of our readers should happen to be interested, as politicians, in parliamentary campaign literature, this point might be taken by them, for the facts are as we have given them. Besides, supposing compulsory arbitration to be all that the fancy of New Unionists paints it—and they would not profess such admiration for it if they thought it likely to interfere with their own interests—those who undertake to manage appeals on behalf of the men must first learn to be as businesslike as the employers usually are. There is an air of unreality, of theatrical posing, about the recent railway men's agitations that would condemn them in advance before any respectable Court of Arbitration.

The Transvaal War and the Gas Industry.

The subject that has been most prominent in the minds of our readers, in common with the rest of their co-patriots, during the past twelve months has necessarily received but small notice in these columns; for—while we always endeavour to bring under consideration such events in the work-a-day life of the world as touch the interests of all concerned in the gas industry, or as afford lessons of value to those in whose hands the administration and care of its undertakings lie—the progress of the Boer War has, in the main, been a subject altogether beyond the purview of the "Journal." There is, however, one respect in which the upshot of events in South Africa directly touches the acetylene gas industry. It may be remembered that twelve months ago we called attention to the gross injustice done by the Transvaal Government to the English firm of Read Holliday and Co. (the patentees and makers of acetylene gas apparatus) by conceding to another firm—in consideration of that firm undertaking to pay to the Government 10 per cent. of the profits of the concern after the third year—the sole right to make and sell calcium carbide in the Republic, in spite of the fact that Messrs. Read Holliday and Co. had previously taken out licences under the Transvaal Patent Law securing such exclusive right of manufacture and sale.

The Transvaal is now no longer a republic, but is an integral part of the British Empire. Mr. Kruger has thrown up the sponge; and, though a difficult task still remains to be performed before the complete submission of the irreconcilable rump can be secured, the new *régime* can be said to have begun. One of the first evidences of this fact also affords our reason for saying that the result of the war directly affects the industry the "Journal" claims to represent—we refer to the notice as to concessions in the Transvaal issued by the High Commissioner for South Africa on

the 8th inst. This notice is to the effect that every concession granted by "the late Government of the South African "Republic" will be considered by Her Majesty's Government on its merits, and that the Government reserves the right to modify, or to decline to recognize, any concession which may appear on examination to affect prejudicially the interests of the public, or to have been granted contrary to law. A Commission has been appointed to make the necessary investigation into the circumstances and terms of the granting of all concessions; and the Commissioners will meet for the first time on the 1st prox. The concessions into which they will, in the first instance, inquire include those conferring the sole and exclusive power of manufacturing, importing, or dealing in any commodity in the Transvaal. All persons desiring to be heard are to communicate with the Commissioners at once; and so Messrs. Read Holliday and Co. will, we trust, soon come by their own again.

The war has been not without its indirect effects upon gas undertakings. It has had some share in raising the price of coal; it has, both by the calling out of the Reserves and by the stimulus given to recruiting, caused the supply of labour to be diminished at a time when the demand has been exceptionally heavy; and it has helped to keep up the prices of iron and steel goods. It has, moreover, considerably affected the finances of the country—the lessened output of gold raising the price of money and lowering that of gas stocks; while the heavy war expenditure, with the consequent shilling income-tax, has checked to some extent the previously growing prosperity of the country generally. As Mr. L. L. Price pointed out the other day, in his paper on "Some Economic Consequences of the South African War," read to the British Association, the increased military expenditure that has been and will be necessitated may be accounted "unproductive"—in a strict interpretation of the term—while "the growing pressure of foreign competition "in our own manufactures and trade, coupled with the in-"creasing cost of obtaining the coal which is still the source "of much motive power, and the large additions made to "local and municipal indebtedness, may render it desirable "to husband resources and avoid any augmentation of the "National Debt." On every ground, individual, industrial, and national, those responsible for the management of the gas undertakings of the country may well rejoice at the approaching successful termination of the war, which has been so lamentably costly—both in blood and treasure.

WATER AND SANITARY AFFAIRS.

It is in the highest degree gratifying to find that the prompt measures taken by the sanitary authorities of Glasgow have had the effect of checking the spread of the terrible scourge which appeared in a certain part of the city a few weeks since, as noticed in the "Journal" for the 4th inst. The official bulletin issued last Thursday showed that the number of cases of plague under treatment were sixteen, though as many as seven times this number were under observation. Fortunately, the majority of the patients in the hospital were out of danger; and as the maximum period of incubation had passed on the 5th inst. without any fresh cases having arisen, it was confidently believed that the disease had spent itself. All the houses in the isolated area have been disinfected; and it is to be hoped a clean sweep will be made of them. It is a curious feature of this remarkable outbreak that, while the inhabitants have shown a disposition to co-operate with the authorities in their precautionary work, priestly influence has been brought to bear in one of the most important branches of it—viz., the cremation of the dead. Religious fanaticism showed itself in another direction—the walls in certain parts of London being scored over with expressions calculated to alarm the unthinking, though no one was mad enough to utter any denunciations from the steps of St. Paul's. Of far more importance to the Metropolis than these hysterical exclamations were the reassuring statements made by Dr. W. H. Power, one of the Medical Officers of the Local Government Board. He told a representative of the youngest of the morning papers that the Board have not the slightest fear of an epidemic of plague in London, for the reason that they have perfect confidence in the efficiency of their machinery for restricting an outbreak. He laid stress upon the foolishness, and even danger, of alarm; and added that, with our elaborate system of notification, isolation, and disinfection, "one, two, or even three cases of "plague in London should not send the people into a panic "any more than a case or two of typhus." Each disease, as we remarked when dealing with this matter a fortnight ago, is the product of the accumulation of filth; and Mr. Baldwin Latham has pointed out in a recently issued work on "The Climatic Conditions necessary for the Propagation "and Spread of Plague," that this particular scourge is "greatly influenced by pestilential emanations from polluted and water-logged soils." Moreover, it attacks the poor and those who are living on low diet. It is an aphorism in the medical profession that if the cause is removed the effect will cease. It is therefore the business of the true sanitarian to turn his attention to any places—and there are probably not a few—where conditions such as those above indicated exist, and set about improving them with as little delay as possible. The bacillus of plague will not find a permanent home where there is plenty of pure air and water, and where personal cleanliness is attended to, as, happily, it is to a greater degree than it has ever been.

The International Health Congress, some of the proceedings at which have been noticed in previous issues, was not the only one at which sanitary matters have lately been discussed in Paris. In response to a cordial invitation from the French Society of Hygiene, the Sanitary Institute held last month a series of meetings, at which some important questions were discussed. Among them was that of river pollution and the purification of sewage, which was introduced in an address delivered by Mr. T. de Courcy Meade, City Surveyor of Manchester. He pointed out that, though the problem of preventing the pollution of streams at reasonable cost had been for some time before municipal authorities, the solution seemed to be as far off as ever. He thought, however, it had been found by the Mersey and Irwell Joint Committee, who control an area of about 483,000 acres, with a population of 2½ million inhabitants. Most of the sewage undergoes treatment before it is allowed to pass into the rivers—the solids being removed by purely mechanical filtration. Speaking upon this subject. Dr. S. Rideal said it was possible, under certain circumstances, to allow a specified amount of sewage matter to pass into streams; the problem was to ensure that the latter should remain pure. He thought future legislation should be based upon the ratio of the volume of a river to that of the sewage matter discharged into it. He supported the opinion held by previous investigators, that a great bulk of sewage might go into a large stream without detriment to towns lower down, even where the water was used for drinking purposes. Mr. Roechling was less inclined than Dr. Rideal to rely on the self-purifying power of rivers. He expressed the opinion that where streams into which sewage is discharged are used for providing supplies of drinking water, the sewage should be first purified, no matter by what system. At the same time he thought that effluents from bacterial works should be regularly and carefully watched, as it would often be found that luxuriant vegetation was produced, which was liable to cause putrefaction. It would seem, therefore, that, while the pouring of untreated sewage into a stream is unattended by serious consequences to people living a few miles below the point of discharge, the modern processes of treatment must not be too confidently relied upon to produce a perfectly harmless effluent. Dr. Rideal's suggestion as to fixing the ratio of the volume of sewage to that of the stream into which it is discharged, is a good one. But before the Legislature could be asked to do anything in the direction indicated, searching inquiry would have to be instituted; and this could best be undertaken by a public department such as the Ministry of Health which is now being called for by sanitarians.

English Gas Engineers at the Paris Gas Congress on "Gas Manufacture" Examinations.—In our *résumé* of the technical proceedings at the International Congress, we gave, as they merited, rather prominent notice to the remarks of Mr. J. W. Helps (the President of the Institution of Gas Engineers) and of Mr. Charles Hunt, with reference to the "Gas Manufacture" examinations of the City and Guilds of London Institute. In connection with Mr. Hunt's observations, and in extension of what we reported last week, it may be said that Mr. Helps acknowledges the difficulty that would probably be experienced if the examination papers were set by a body of examiners, and states that his idea is that the examination should be undertaken by such a body, with power to appoint and delegate to some qualified person the setting of the questions. Nominally, however, the examination would be conducted by the properly organized body of gas engineers, and would, he thinks, acquire importance from this fact.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 720.)

LAST week opened full of promise for the Stock Markets. A more cheerful feeling in regard to affairs in general prevailed, strongly aided by the sure signs of the approaching termination of the South African war; and this, coupled with easy money conditions, brought in buyers. Nor was the buying confined to the covering operations of the professional element; for it really seemed as if the public were beginning to nibble. The rise was at its height on Wednesday, when the flight of Kruger was announced. But then a reaction set in, with a strong tide that swept everything down again, with the result that all the advances were lost, and in some instances more than lost. A very disappointing sequel to a short bright interval! The Money Market was irregular too. At first, the chief characteristic was marked easiness; but later demands, coupled with the requirements of the Stock Exchange settlement, produced a degree of hardness. Business in the Gas Market was on the whole only moderate; and it was very fitful throughout. On one day there would be quite a revival of animation; and by the next it had all died away again. The tendency, however, was good, and continued a general disposition to recover from the late depression. The changes in quotation are few and moderate; but with only an unimportant exception, they are all for the better. In Gaslights, the ordinary was fairly brisk, considering the average of activity, and very steady—never ranging outside the limits of 97¾ and 99. Hardly anything was done in the secured issues. South Metropolitan was moderately dealt in at about middle prices, but no better. Commercials were unnoticed. The Suburban and Provincial group displayed more activity, especially Brentford and Tottenham; and several issues showed improved values. The Continental Companies were remarkably quiet, and were quite unchanged, except for a small advance in Imperial. In the remoter world, Cape Town alone made a change. The tendency in Water continued favourable; and Kent, Lambeth, and West Middlesex had more or less of an improvement.

The daily operations were: Business in Gas was brisk on the opening day; and prices were firm, but quotations did not move. In Water, Kent rose 5, and Lambeth 1. Business in Gas died away on Tuesday; and again quotations were unmoved. In Water, West Middlesex rose 1. Wednesday was another quiet day; but prices were good. British rose 1, and Cape Town ½. Thursday was a little more brisk; and Crystal Palace and Tottenham "A" rose 2 each. Friday was more active—mostly for Gaslight issues. Imperial rose 1; but Cape Town debenture receded 1. Lambeth Water gained 1. Saturday was quiet, and without change.

ELECTRIC LIGHTING MEMORANDA.

Refuse Destruction at Bradford—The Performance of the Plant—Combination Destructor and Electric Lighting Plants not Expedient.

AT last, after many years worse than wasted in the hopeless attempt to yoke the destruction of towns' dust to a general electricity supply station, and exhibit the combination as a working success, the whole thing has been blown upon. It happened at Bradford, the minister who operated the exposure being Mr. M'Taggart, the Cleansing Superintendent of the city. He read a paper before Section G of the British Association, which should effectively extinguish the last flickerings of an organized deception that the "JOURNAL," at least, has consistently combated from the very beginning. The ease with which one local authority after another permitted themselves to be misled in regard to the economical possibilities of this loudly-trumpeted combination, has been anything but creditable to the collective wisdom of these bodies. The people who made a living out of the business have been able to keep it up for a good spell, owing to the notorious reluctance of local authorities once deceived to confess the fact. To their credit be it said, the leading technical journals devoted to the electric lighting industry never lent any support to this delusion; and one of them came in for much obloquy for its scepticism in regard to the great Shoreditch undertaking. Their attitude in this respect has been the same as that taken by the "JOURNAL." For the process of towns' refuse destruction by fire, we have had nothing but praise. It is the only sanitary way of dealing with such absolutely waste matter, the necessary, but none the less offensive *dejecta* of a living town. To pretend that the stuff has any real value, whether for generating electricity or converting into illuminating gas, has been regarded in these columns as offending against the plainest of scientific conclusions from indisputable facts.

In respect of refuse destruction, the experience of Bradford is often referred to as conclusive. The expedient has been of necessity adopted by the Bradford Corporation in a most thorough-going fashion. Fortunately for the ratepayers, the Corporation were wise enough to see the advisability of doing one thing at a time. The duty of satisfactorily disposing of the town's refuse was imperative; and the Cleansing Committee felt that it was difficult enough to call for the most careful fulfilment, irrespective of all possible ancillary considerations. One essential to the perfect discharge of their obligations the Committee saw to betimes—they obtained the services of a good manager for the department, and had the whole service put in scientific trim. After seventeen years' experience, they could expect to get the work done properly. There are, of course, about a destructor station many small but important details which nothing but ample experience is competent to effectively deal with. They seem to have got everything pretty nearly right at Bradford by now. Mr. M'Taggart has just published the results of a complete fortnight's working. It seems remarkable, if it is true, that the publication of results of so long a test-period is unique. One would naturally suppose that those who are interested in any way in an apparatus that is nothing if not good for continuous operation, would not be content either to buy or sell such plant on the results of a one, two, or even twelve hours' test. Yet Mr. M'Taggart more than hints that this is the usual proceeding. If so, the municipal purchasers must be worse men of business than one would believe to be possible.

Mr. M'Taggart's fortnight extended from June 24 to July 7 last. During this time, the usual summer refuse was disposed of, amounting to 1293 tons. The rate of working was 9·3 tons, or 543 cubic feet, per "Horsfall" cell per 24 hours, at a labour cost of 9d. per ton. The products comprised 365 tons of clinker, 12 tons of fine ash, 2·67 tons of flue dust—total solid residuals, 380 tons nearly. The other residual was steam, which was generated at the evaporation rate of 0·743 lb. per pound of refuse. Corrected to evaporation from and at 212° Fahr., the duty of the refuse was 0·882 lb. of steam per pound of the fuel. The total amount of power generated was 387 indicated horse power per hour, which was utilized in grinding mortar, crushing clinker, making artificial stone, and converting the fish refuse of the city into manure. Steam is also supplied to a disinfecting station; and the rest goes to make electricity for lighting the establishment. There is none over. In answer to questions on the point, Mr. M'Taggart told the Section that the possibility of generating electricity from refuse had received much consideration from the Cleansing Committee, who had not seen their way to go further into the matter than simply to light their own works and the limited area adjoining them. He was dead against the idea of a combination plant; the calorific value of the refuse to be dealt with varying so much from day to day that it would be inadvisable to bind the destructors to deliver a fixed amount of power, which they would be unable to do without using coal. "If they wished to have an electric lighting works," said the Cleansing Superintendent, in a fine burst of commonsense, "let them have one, and thoroughly up to date. If they wanted a dust destructor, let them have it as a destructor, and make that thoroughly up to date; and let them utilize every atom of power in some other useful work, such as the manufacture of bricks and tiles, and he believed it would some day prove to be as thoroughly remunerative as the generation of electricity." All this is endorsed by the "Electrical Review;" and we agree. The supply of steam for central station electricity generation is about the least suitable application of refuse-destructor heat that could well be proposed. The one is the type of intermittent, high-pressure working at daily intervals; the other is of the type of those machines which work night and day throughout the week, stop altogether on Sundays, and never know from hour to hour what the output may be. The two types will no more run together than a dust cart and a dynamo. It cannot be done. So far as the reduction of the expense of working a destructor by the suitable utilization of otherwise waste heat is in question, this is a laudable aim wherever the conditions permit. But to say that electricians are the only persons who have ever thought of doing this, is to utter that which is not true. It is true that they have made most use of the suggestion as jam for concealing the bitter taste of an expensive electric lighting installation; but the idea is scarcely one to be proud of having originated.

Calcium Carbide Works in Great Britain.—In the course of a recent article, entitled "The Technology of Acetylene" (*ante*, p. 464), in which we reviewed Professor Vivian B. Lewes's book on the subject, we remarked that—in a list of carbide works at present running or in course of construction, given by him—he had failed to name any works in Great Britain except those at Foyers. We added that the Foyers works belonged to the Company which had acquired Willson's English patent rights; and that, while in respect of other countries the list was a tolerably complete one, we were surprised that such works as those at Blackburn and Cradley Heath, and those at present under construction in North Wales, had been omitted from it. Such omissions, we considered, would have seemed to be intentionally misleading, if Professor Lewes's impartiality were not beyond question. We have now been asked to state that there never have been carbide works at Blackburn; that those at Cradley Heath have ceased to exist; and that at present there are no works in construction in North Wales. In so far as the Cradley Heath works are concerned, we have pleasure in accepting the correction; but our information to the effect that a Blackburn firm is making carbide, and that works capable of utilizing 4500-horse power in carbide manufacture are in progress in North Wales we cannot at present discredit. Moreover, to show that our comment on Professor Lewes's list was justified, we may add that we are informed that Messrs. Tinker and Holliday, Limited, of Huddersfield, have manufactured carbide at their works at Hazlehead, Sheffield, for nearly two years.

METHODS OF ADVANCING THE WELFARE OF THE WORKING CLASSES.

[First Article.]

In the "Journal" for the 14th ult. we noticed at some length Dr. N. P. Gilman's work on Employers' Welfare Institutions,* but only dealt then with the author's own views on the moral duties of employers to their workpeople—which formed merely the preface to the main part of his work—and with the subject on its general and abstract side. In doing so, as we said, we were unable to touch upon what, without any disrespect whatever to the opinions which Dr. Gilman expresses, we may call the most valuable section of his book—namely, that in which he gives us an account of what some of the principal employers in different countries have done, and are doing, towards the fulfilment of their duties in regard to the social, moral, and pecuniary welfare of their servants. This record has obviously required for its compilation much time, inquiry, and industry. The labour involved has, however, produced a very full and valuable description of all the various institutions and schemes which have been founded and put in operation by one or another of the most enlightened among the employers in different countries; and Dr. Gilman doubtless feels that his time and trouble have been well spent. He has certainly laid under an obligation to him all those who believe in the need and value of some union between master and man beyond the mere "cash nexus," to use the term with which Carlyle made us so familiar. We now, in accordance with the intention expressed in our first notice of Dr. Gilman's book, propose to indicate some of the directions in which efforts have been made by employers to establish some higher relationship with their employees than that of mere buyers and sellers of labour.

Dr. Gilman first describes the welfare institutions existing in Germany, which institutions and arrangements are generically known as Wohlfahrtseinrichtungen, which may be freely rendered as "Examples of personal care for their workers by employers." The traditions, constitution, and characteristics of the population there permit of the exercise of a considerable amount of almost military discipline, and also of what in this country would, we fear, be considered "grandmotherly care" on the part of the German employers. But many of the arrangements made by them are in every way admirable and possible of adoption, where not already adopted, in this country. The majority of these arrangements for the comfort and well-being of employees will be comprised in an account of those in operation at the works of the famous Krupp firm, which Dr. Gilman very fully describes.

The gigantic concern of Fried. Krupp (employing over 40,000 hands) is, of course, of such magnitude that some of its institutions and benefit schemes would be scarcely practicable, if possible, for a smaller firm to adopt; but most are capable of being copied on a smaller scale. First, and of most certain benefit, are the arrangements made for housing the employees. Workmen desirous of purchasing their own houses can borrow the necessary amount, at 3 per cent., and repay by instalments within 25 years. But, while many avail themselves of these facilities, a far larger number live in the houses built and let out by the firm. The colony of Kronenberg (the principal of several such "colonies" laid out by the Krupps) contains 226 neat three-storey houses of stone and brick, with a church, schools, post-office, stores, library, restaurants, large hall, park, &c.; the streets are shaded with trees; and the houses have garden patches. Water and gas are supplied to each house. Altogether the firm have laid out over half-a-million of money on these colonies, making thereon an income of a little over 2 per cent. The houses are so popular that "a seniority of ten years' service is usually required of a tenant." There is also a lodging house for 1200 single men, provided with a restaurant and reading-room. "The management is of military strictness."

The Krupp firm also support and administer 51 stores for the supply of good quality food, clothing, &c., to the employees, among whom the profits are divided annually. The restaurants —of which there are seven—have gardens; while some have, in addition, bowling alleys. Baths are provided at most of the works. Sick and burial clubs are well supported; the aid given by these funds being at more generous rates than those usually in vogue. At Essen, a hospital containing 150 beds, which served originally as a barracks for the wounded in the Franco-Prussian war, is maintained for the use of the employees, their wives, and children; while in connection with their other works the firm contribute to the support of the neighbouring hospitals. Pension funds exist for both the men and the officials; and provision is made for the widows and children of any of the latter who may be accidentally killed. Life insurance is strongly encouraged; the firm contributing one-third of the premiums, and paying all the expenses of the Association through which the insurances are effected.

A special fund exists—established by Herr Krupp in memory of his father, and endowed with a million marks—for meeting special needs in individual cases, such as that of a long and severe illness in which the sick fund support proves insufficient. Out of the same fund medical attendance and medicines are provided for the pensioners. The firm have always freely supported and encouraged the cause of education, building and endowing schools in connection with several of their works, and substantially contributing to the expenses of others. All the apprentices are required to attend secondary schools; and a special fund is applied to obtaining higher technical education for the sons of overseers and workmen who have distinguished themselves by good conduct and capacity. There is an industrial school provided for women and girls, and also one for the teaching of housekeeping. Special facilities are granted and every encouragement is given to all employees desirous of saving money; the firm themselves receiving deposits from the men at 5 per cent. interest. The mention of the provision of dining-halls for the workers, where food is to be had at cost price, and of a well-equipped club for the officials, brings us to the end of a rough outline of what the firm of Krupp have done, and are doing, for the welfare of the nearly 100,000 souls directly connected therewith. It is a record of which any employer might well be proud.

There are few (perhaps there is not one) among the multifarious plans adopted by this great—and, be it added, most flourishing—German firm that have not suggested themselves to and been put into practice some by one, some by others of the employers in this country. But the recital of them all must serve as a stimulus to the nervous and half-hearted to go further in the direction of concerning themselves with the personal welfare of their men. For the Krupps have shown plainly that the maximum amount of consideration for the employee is compatible with the prosperity of the employer. It is, perhaps, necessary to add that if benefit schemes be instituted primarily with the idea of the firm deriving profit from their existence, and not from a real sense of duty and a genuine appreciation of the great possibilities for their men's good or evil that offer themselves to all employers, those schemes are foredoomed to failure, so far, at least, as the selfish object of their institution is concerned. For motives, like truth, will out; and no one has a keener appreciation thereof than the British working man. Moreover, as a German employer has said: "What is given to the workpeople should not be given with condescension. The *manner* in which it is given is of consequence; human sympathy should plainly appear." It is, therefore, to the employer who would, an he knew how, do all he in reason, and with proper regard to the interests of his business, could do, that this account of what one firm have done, without prejudice to their prosperity, will be of real use.

Before passing on to note points of interest in connection with the benefit schemes adopted by other firms, we may perhaps make one or two remarks on those instituted by the house of Krupp. The policy of affording extensive facilities to the hands to acquire or to rent decent dwelling-houses, cannot but strongly recommend itself to those whose business is on any considerable scale; especially where—and in the case of gas undertakings it is a necessary sequence—that business is situated in a large town or city. The housing question is becoming more and more a pressing one; and, as is the case with many large and difficult social problems—such as that of provision for old age—very much can be, and is being, done towards its solution by private initiative, while the faddists air their fads, and legislative lethargy endures. It is, moreover, a distinct advantage to a gas company to have a fair number of their employees living within reasonable distance of the works, near together, and, consequently, easily summoned in all cases of emergency. The encouragement and facilitation (by arranging for the payment of premiums monthly instead of annually, or in various other ways) of life insurance is another very commendable method of assisting employees—possessing, too, the advantage of increasing the spirit of independence among the men. When we speak of the spirit of independence, we mean of that true independence which consists in a man doing, and wishing to do, everything he can to support himself and his family, and to provide for them should accident or worse befall him; not the spurious independence for which the agitator loudly clamours, but by which is meant only too often nothing but the negation of any sense of duty from man to master.

The provision of a fund for the alleviation of special cases of hardship is a step which, to anyone at all closely acquainted with the various circumstances that arise in the history of a large body of employees, will appear certain of most beneficial results if the fund be properly and carefully administered—a proviso which may, of course, be attached to every "welfare" scheme, but especially to the one in question. A man may have an illness of a character that demands, for its successful combating, food of a special and expensive kind, aided by a change of air; a five-pound note added to the club allowance (often scarcely adequate for the provision of the bare necessities of life) may restore to the man his health, and to the employer a valuable and grateful servant. Or protracted sickness may fall upon the wife and children of a man who may have been unable to save sufficient to meet such an emergency. In such a case, again, pecuniary assistance offered in the right spirit, at the right time, may be as seed falling upon a fruitful soil. The administration of such a fund needs personal care and thought no the part of the donors. It would, however, surely bring its own reward.

Another plan worthy of wide imitation is the provision of good meals at reasonable prices to the employees and staff. Nothing

* "A Dividend to Labour: A Study of Employers' Welfare Institutions." By Nicholas P. Gilman (Houghton, Mifflin, and Co., Cambridge, Mass.)

is more essential to the development of a youth into a good workman or official than that, while he is growing and his earnings are small, he should have wholesome and sufficient food. The pallid boy whose mid-day meal consists of a cup of tea and a bun or roll and butter, or of a hunk of bread and cheese and beer, will do a poor day's work, and will make a man of little energy and indifferent health. It is, we believe, a sound investment for a firm to provide its youths and apprentices with a square meal in the middle of the day free of charge, or for the bare cost of the victuals. If, in addition, there be put at the disposal of the staff a reading and smoking room where they can find something better to read than the snippy papers, or the wearisome agglomerations of ill-printed photographs of uninteresting people that go by the name of magazines, which appear to form the staple "intellectual" diet of the rising generation, a further benefit will have been conferred upon the employee calculated to bear harvest for the employer. A reference technical library should be found in any such room on a gas-works.

Turning to the welfare schemes of other employers in Germany, we may note, as additional to those mentioned as in force at the works of Herr Krupp, that in several cases, as might be expected in that country, musical instruction and performances are given considerable prominence. For instance, at Herr Max Roesler's earthenware factory the musical union has a large membership, and is an excellent bond of friendly feeling between Herr Roesler and his employees. The various holidays are here musically celebrated; and the chorus combine pleasure with business by forming the fire brigade of the works. All the male hands are also required to be proficient in gymnastics. In the case of other firms, provision is made for sending children into the country during the summer; for enabling wives to buy sewing machines and men to buy bicycles on easy terms; for making small loans for special purposes to employees, at a moderate interest and repayable in weekly instalments; or for providing garden allotments.

There is little that calls for notice in respect of the "patronal institutions" in France, many of which follow on the lines of those already described. It may, however, be mentioned that pension schemes are largely in vogue there; nearly 20 per cent. of the total number of employees being insured against the time of their incapacitation from work by old age.

We will leave to another article the consideration of Dr. Gilman's account of what British employers have done for their workpeople, and the section of his book that deals with profit-sharing arrangements in England and other countries.

THE BRITISH ASSOCIATION AND MUNICIPALISM.

First Notice.

The only portion of the transactions of the Sectional Meetings of the British Association at Bradford which possesses particular interest for "Journal" readers was that which occupied one sitting of the Section of Economic Science and Statistics, when a group of papers relating to various aspects of Municipal Government were read and discussed. Mr. Arthur Priestman contributed the most thorough-going plea yet put forward by a man of affairs for the almost limitless extension of municipal trading. One is well accustomed to advocacy of this kind from budding Socialists of the platform and the Press, whose zeal for every kind of shop-keeping, which they call Progress, shuts out every other ideal of municipal activity. It remained for Mr. Priestman to formulate the creed of the municipalizer in a form and place proper for either defending or attacking it. As he remarked in the beginning of his paper, the subject of municipal trading is "ripe for discussion." It is, indeed; and it is high time that public opinion took some shape in this regard. For the present, as in the past, practice in this respect has outstripped theory. Few persons of "light and leading" appear to have made up their minds as to whether the branching out of municipal institutions into commercial enterprises is or is not desirable on general principles. Meanwhile, the process has already gone to great lengths, and every such movement that does not result in patent failure is immediately utilized to support the argument in favour of still further "progress" in the same sense.

It was, therefore, quite in accordance with established rule that Mr. Priestman should base his case for more municipal trading upon the asserted success of municipalized traffic in water, electricity, and gas. Whenever during the past controversies upon the question of the expediency of transferring gas undertakings to local authorities the disadvantages of the proceeding were rehearsed—as they have often been in these columns—nobody thought of laying much stress on the "thin-end-of-the-wedge" objection. Yet this is precisely the criticism that now penetrates to the heart of the modern form of the question. Municipal gas-works, it is argued, do so well that other enterprises under the same auspices are likely to prove equally prosperous and satisfactory. It is worth remembering that it was municipal water supply which led the fashion for municipalizing gas. Now Mr. Priestman jumps at a bound from the supply of water to that of milk, and declares that "every argument used for the public ownership of the water supply applies with equal force to the milk supply." This shows the advocate's position with a clearness that leaves nothing to be desired. Once prove that a certain supply has to be forthcoming, or service performed, and his conclusion follows that the local authority ought to do whatever is required.

This is obviously the exact opposite of the view that has hitherto prevailed in this country, dating from the far-reaching decision of Parliament, under the influence of Peel, that the balance of advantage was on the side of the private ownership of the national railway system. The value of this decision has been incalculable. There is, of course, much that is imperfect in the British railway system; but nobody who knows the truth of the matter would prefer governmental control, as it is illustrated in other countries. Now the validity of the same general principle is being undermined by insidious municipal sapping. First the water supply, next the tramways, then the gas, then the electricity—and now it is banking, insurance, and public-house management. It is difficult to draw the line. As we have always allowed in the "Journal," the decision in every particular case must be taken on its merits. Mr. Priestman, and those who think with him upon the matter, are concerned to give a cumulative force to the whole body of accomplished facts. They would argue that because one hundred gas-works have been municipalized, that furnishes conclusive proof of the expediency of similarly treating the one-hundred-and-first. This we flatly deny, and say further that it will be an evil day for England when any such hypothetical pretension is allowed to overrule particular merits in any case.

There is no solid ground for the erection of any "principle" of municipalization outside the particular merits of every case. Are you still determined to treat the subject as one of principle? Then what evidence for or against the acceptability of the principle are you going to admit? To begin with, the spectral form of Municipalism paralyzes, at sight, that very power of private enterprise with which it is contrasted by Mr. Priestman and his school. We say it without the slightest fear of contradiction—that the possible prospect of a transfer is enough to damp the commercial spirit of a gas company. It is, and must be, the same with every industrial concern in similar circumstances. The management merely "marks time" while negotiations are pending. It is not worth while to do anything more than is absolutely necessary to carry on the business. Real enterprise is choked off. Not only are improvements obviously desirable postponed indefinitely, but the heart is taken out of the trade. It is unnecessary to more than allude to the blight that the tramway industry of Great Britain has suffered from the bestowal on the local authorities of a reversionary right to this class of property. The shadow of the inevitable expropriation lies across the service for years; and it is no credit to the municipal owners, when they come into possession, that they are usually able to effect notable improvements.

The whole case of municipalizers like Mr. Priestman, rests upon the premiss that defects in local services and supply undertakings are only remediable in one way, and that the way of their admiration. Whether it is the question of the better housing of the poor, or the supply of milk, these partisans shut their eyes to the possibilities of all other means of improvement besides the undertaking of the job by the parish. That is what it amounts to. A wider view of the situation, as it has existed in other circumstances, does not show much to encourage this short-sighted solution. Free capital and brains are always seeking employment; and Mr. Priestman's ideal of municipal development is that they should be warned off from all city employment. People with money should be content to let the local authority take care of and employ it for them; and persons with brains must rest satisfied with the modified prosperity to be found in municipal service. Of course, this is the rankest Collectivism; but that is the natural goal of Mr. Priestman's endeavours, and there is nothing short of it where a halt may be called.

Mr. Priestman's aspirations did not even stop at mere local or parochial Collectivism. The advanced price of gas coal has sorely vexed the Bradford Corporation Gas Committee, as it has other gas manufacturers. It is significant of the bent of mind produced by acceptance of the principle of Municipalism, that Mr. Priestman's first thought of a remedy for this dearness of gas coal is a municipal coal supply. "To resist the imposition of high charges, we shall probably find it a wise and necessary step to use the resources of the Municipality to evade the effects of a monopoly which endangers the very existence of our trade." Why did not he state in plain English what he must have meant by this guarded language, if he meant anything at all? Bradford Corporation Coal Mines, acquired or made on purchased lands; Bradford Corporation Iron-Works, Railways—what else? The private trader, when faced with an advance in the cost of raw materials, or of labour, or of any other item of expenditure, does not talk thus. If he thinks, as Mr. Priestman does, that the dearness is due to a "syndicate" of producers, he does not take this as constituting a good reason for trying to break that syndicate, with the aid of borrowed capital. He merely reduces his demands to the smallest possible figure, and awaits the inevitable collapse of the "ring." In addition, he casts about for other ways of recouping himself. This is the opportunity for the improver, or the inventor, who may have suggested vainly for years the advantages of making this or that alteration in the conduct of the concern. Accordingly, some labour-saving machine gets a trial, or a fuel-economiser long contemplated is at last actually ordered.

Not to put too fine a point upon it, many of those who dis-

believe in the "principle" of municipal trading most profoundly are guided to their opinion by regard for the fact that in its very essence it opposes an artificial rule of efficiency to the natural forces which mould free trades and industries. There is no inducement to deal with hard facts on their merits, where there is a political principle to be followed and defended. The motive to individual initiative is nipped. A municipal corporation cannot improve its plant at almost any cost, as a private manufacturer does. The satisfactory result of the extensive municipalization of gas supply in the United Kingdom is one of the stock commonplaces of the theoretical municipalizer. As already remarked in this article, it is used as a wedge, and with enormous effect, especially upon those who are not profoundly conversant with the subject. Well, there is another view of the matter, which we venture to put here for what it may be worth. It should be unnecessary to premise that we have no individual examples in mind, and admit the existence of exceptions. But stated broadly, there is, on the one hand, the fact, gratefully dwelt upon by Mr. Priestman, that the municipal ownership of gas undertakings has already been carried farther in the United Kingdom than in any other country. He notices that only 11 out of 355 scheduled gas undertakings in the United States are public property. On the other hand, there is the fact, mournfully acknowledged by experts, that the gas industry of the United Kingdom is more barren than that of foreign lands in important technical discoveries and inventions. Is there any connection between these concurrent conditions of the British gas industry? Is the dead hand of the parish beadle to be traced in this department of municipal "enterprise?"

Again, electric lighting and electricity supply is claimed as a municipal preserve in the United Kingdom. On the other hand, the superiority of the United States in regard to commercial applications of electricity is one of those contemporary truisms with which, as Mr. Priestman remarks, few newspaper readers would find cause to quarrel. It is, therefore, at least a curious circumstance that, of a total of 952 electric light plants scheduled as operating in the United States, only 320 are municipal property. Mr. Priestman does not mention street railways, one of the most characteristic of American specialities. We are always having it dinned into our ears how great are the facilities for rapid transit throughout American towns; and the municipalities have had nothing to do with it. Upon Mr. Priestman's own rule that the good of the greatest number must be the only consideration in fixing how public services should be rendered, municipal action is hopelessly behindhand in the two hemispheres.

Mr. Priestman does not shrink from the logical conclusion that there is no objection whatever to the rates being drawn upon for competition with private capital. Fortunately for the community at large, Parliament is of an altogether different opinion. How much private capital would be laid out in public service works if the local authorities were at liberty to enter the field at any moment, and compete for the business? What has recent experience to say respecting the conditions which had to be laid down before a single electric lighting company could be started in this country? Mr. Priestman passed very lightly over the difficult detail of the direct employment of labour by a municipal corporation, at "model" rates of wages and under "model" conditions as to working hours and general advantages. He thought it high time for the condition of the "masses" to be improved, through the activity of an enlightened municipal policy. This is as much as to admit that, in his scheme, the mass of the working population should be in municipal employ. He also hinted that he did not see why members of municipal corporations should not be paid for their valuable services in looking after the municipal departments. So the local authorities of the future are to live by and upon themselves. The state of that legendary community who lived by taking in one another's washing seems simple in comparison with Mr. Priestman's ideal for the Bradford of the future. Like most other prophets of his cult, moreover, Mr. Priestman tries to sit at once upon the two stools of the system—the making of a profit from, and the improvement of, the municipalized services. Whereas the bulk of his paper appears to insist on the reasonableness of corporation trading departments, such as gas-works, being carried on at a profit for the relief of the rates—even if it is necessary to start a coal mine to do it—towards the end he quotes approvingly from the Lord Provost of Glasgow, who, when asked before a Royal Commission (? Parliamentary Committee) why a company could not develop the tramway system as the Corporation had done, replied that "the Corporation and the Company had different aims in view. The Company made profit their first consideration; whereas the Corporation were principally concerned with the comfort and convenience of the citizens." Now, which is the right rule to follow? Upon which stool will Mr. Priestman elect to sit? The two positions are absolutely irreconcilable; for a municipal committee can always return just what rate of profit they choose, by a stroke of the pen. This is the way to cheap municipal glory; whereas merely carrying on an undertaking at cost price, for the comfort and convenience of the citizens, is such a thankless job that few English local authorities pretend to do it.

So much, for the present, for Mr. Priestman. His paper has the merit of candour, and distinctly tends to clear up a somewhat hazy question. We shall hope to devote a second article to the remainder of the proceedings of the Section.

LABOUR SAVING IN AMERICA.

The letters of the special correspondent of "The Times," reporting the result of his investigations into the conditions under which the engineering trades work in the United States—with special regard to the bearing of these conditions upon the question of whether American machinery and goods are at all likely to enter into active competition with English in the markets now supplied with our manufactures—have recently received lengthy notice in these columns; the subject being one of much importance to the users of machinery and to the consumers of coal. Attention was especially drawn to the correspondent's report as to the differences existing between the conditions to be observed in the two countries as regards labour-saving appliances, and the attitude thereto of the working classes. The report was to the effect that employers in this country are very heavily handicapped in the race for supremacy by the obstructive policy adopted by the Trade Unions in respect to the displacement of hand by machine labour.

Confirmatory evidence as to the infinitely more sensible, satisfactory, and profitable state of affairs existing in the United States is afforded by a report recently received at the Board of Trade from the British Commercial Agent in Chicago. Our representative declares that every improvement and every invention by which labour may be saved or time economized, so that the resulting cost of manufacture may be reduced, is at once taken advantage of by the American manufacturer. In all the works he has visited, says the agent, the one great object seemed to be to save unnecessary labour, and get through the work as expeditiously as possible. It is pointed out, as "The Times" correspondent noted, that labour-saving machinery is in the States really labour saving. The ridiculous requirements of the English Trade Union—that only the skilled workmen whose place a machine is designed to take shall be employed to work the machine (be the work never so simple) and that, further, as many workmen as are displaced shall be kept on to run the machinery—are unknown across the Atlantic, or, if known, are only treated as worthy of the contempt of practical men. "Consequently, though wages are high"—mark that, Oh, short-sighted trade unionist!—"the actual cost per piece is very low, on account of one man being able, thanks to these labour-saving machines, to turn out so much work." In one works he visited, the agent was assured that ordinary labourers were being employed in place of skilled mechanics to take charge of some of the lathes and drilling-machines. This was found to answer excellently; because, owing to the perfection in the construction of the machines, the work was practically automatic. The machines were made specially strong, so that an unskilled man might work them without fear of breakages.

Again, of one of the largest establishments for the manufacture of agricultural implements and machinery, the same story is told. Labour-saving machines and appliances are to be seen everywhere. In the forge, for instance, not a hand hammer is found—nothing but tilt hammers worked from pulleys being used, and a few steam hammers for the heavier work. The iron is heated in gas and oil furnaces; electricity is used for lighting, and for actuating some of the machinery; while compressed air is also utilized for the latter purpose.

It is not surprising, we must confess, to read that machine tools of British manufacture do not seem to be in favour in the States; for the American engineer who has shown so much ingenuity and enterprise in the devising and bringing into service of so many mechanical implements, is not likely to be behindhand in the actual manufacture of them. "The designs of some of the American tools are certainly very ingenious; and the work they do is exceedingly accurate. They also appear to run at a greater speed than the English ones."

This, it may be said, is none of it new; it is a twice-told tale. That is true. But equally true is it that it is only the repeated and oft-pondered lesson that is properly and lastingly learned; and the lessons that English employers and English workmen have to learn from the example of their American brethren are of much importance to themselves and to their country. If we thought that the necessity—more urgent than formerly in these days of competition—of gas managers paying the closest attention to all possible means of substituting cheap machine for dear hand labour throughout their works, was universally grasped; that the ultimate loss to the working classes accruing from opposition to such substitution, and from a refusal to work machinery to its full value, was thoroughly realized by them; and that the public appreciated the hindrance to the national advancement that has been caused by the policy of the Trade Unions in this respect—then we should forbear from urging the subject upon the notice of our readers. Facts and not fancies, however, being what the "Journal" has to consider, we once more call attention to a state of affairs by no means creditable to a people generally accounted practical.

CARE OF HIGH-PRESSURE INCANDESCENT GAS-LIGHTS; A NEW INSTALLATION.

Trials of intensified gas lighting continue to extend; and this is a happy omen. When local authorities are induced to make an experiment of a new system, it shows that they have arrived at

the point at which they see there is something in it; and having gained ground to this extent, it remains with those who are exploiting the system, aided by the gas suppliers, to see that further success follows, as it assuredly will do if only a modicum of the attention is bestowed upon the lights that electric arc lamps demand. Indeed, in the high-pressure gas systems lies our greatest strength against electric arc lamps. We mention "gas suppliers" in this connection because they are jointly interested with the owners of the patents in making the systems go. Of course, it is quite impossible for the introducers of these inventions to be here, there, and everywhere to give constant attention to isolated trial installations; and therefore it is to the advantage of the other party concerned to see that an installation within their district is kept at high-water mark.

It has not been suggested to us that we should make these observations; we do so entirely on our own initiative, and for this reason: There is an installation of high-pressure gas-lamps in a public place not one hundred miles from London of which we were pleased to write—and justly so at the time—in a most laudatory manner. Imagine, then, our disappointment, when only on the 21st ult. (the date is intentionally given) we visited the installation again, and found it in a grievously neglected condition. Wrecked mantles were plentiful; and, in some instances, out of clusters of three, one and two mantles were placed *hors de combat*. The lanterns, too, could not possibly be described as clean. Compared with an adjacent electrical installation, the brilliant gas-lamps of a few months ago, which then put their competitors in the shade, presented a woeful appearance. At whose door the fault for this should be placed, we do not know; but surely some interested person should make it his duty to occasionally inspect an installation such as this, in order that he may use his influence to have it maintained at its full light-producing capacity, and in order that the public may have before them a good illustration of what can be done in high-power gas lighting. In a case of this kind, if a gas company has the right, or can obtain permission, to keep a watchful eye on these new installations in public places, in the long run the little expenditure of trouble will be well repaid. Even the strongest children require nursing in infancy. Let it, however, be clearly understood that we do not impute neglect to either the contractors who put in the installation we have been referring to, or to the gas company in whose district it is situated—neither in this particular instance may be responsible. But we wish the remarks made here to be taken more in the light of a suggestion—that is to say, that in such cases the gas company should, if they do not already possess it (and we think the condition of the particular installation in question proves that in this instance they do not), make an effort to secure a supervisory position in regard to it.

Furthermore, what has so far been written has no connection whatever with what follows; the two subjects are merely brought under one heading for convenience. In last week's "JOURNAL," there appeared a paragraph stating that the Intensified Gas-Light Company had completed, for the Strand Board of Works, an installation of their high-pressure system of incandescent lighting in the large refuge lamp immediately opposite the Law Courts. This particular installation, although only a small one, has attracted our attention—firstly, because it is a very good example of how readily, in such situations as this, large lamp columns and lanterns can be converted so that the lighting power afforded is increased more than sixfold; and, secondly, because the lamp column itself is rather an ornamental specimen of work of its kind, and it was not until it was capped in the present brilliant style that its artistic merits were really brought prominently to notice. But at the same time, it is not out of place here to suggest to the Strand Board of Works that this column, like most others in the streets of London, would be very greatly improved by more frequent cleansing. We have recently seen street-lamp columns on the Continent that altogether put our London street-lamps out of the running in respect of cleanliness. The illustration herewith is a reproduction of a photograph of the lamp column to which the Intensified Gas-Light Company have applied their system. It will be observed that the column (which is of bronze) supports five lanterns. The four lower ones are fitted with two burners apiece, each consuming 10 cubic feet of gas per hour, and giving a light of 300-candle power per burner. The top lantern is furnished with three burners, affording together a light practically equal to 1000 candles. Therefore, this lamp now emits a light in this busy locality of approximately 3300-candle power. Formerly the lanterns were fitted with, in all, seventeen flat-flame burners, each consuming 10 cubic feet per hour; and having a total illuminating power of perhaps rather more than 500 candles. The new burners are fitted with an anti-vibrating arrangement, bye-pass, and a ring and chain device for lighting and extinguishing. As we have said, the new burners have been fixed in existing lanterns; but it may be suggested to the Strand Board of Works that, while they have secured a very fine lighting effect, the many-ribbed lanterns of the kind in use are not the best for realizing the highest results.

All that the Intensified Gas-Light Company had to do to convert the lamp to their system was to break the service in the square base of the column, tap off the gas supply, and connect up to the compressor; making the lamp service good again on to the outlet of the compressor, which is fitted in the lavatory beneath. Above the compressor are two gauges which at the

time of a visit last week showed an inlet pressure of 2 inches, and an outlet pressure of 8 inches. The compressor itself (which is about 4 feet high and only 14 inches in diameter) is never touched. When the lights are extinguished, the holder which contains the compressed gas, by means of a lever and plug cock, automatically, on attaining a predetermined height, by the aid of a quadrant cuts the water off. The compressor is capable of serving fifteen burners. But at present it has only to supply twelve—there being besides the eleven in the large lamp, one light fixed in the lavatory, which is sufficient to brilliantly illuminate the whole place. There is one other suggestion that might be made; and it is that, if the Board were to adopt (say) frosted glass panels in the upper part of the doors to the closets, they could, with this one intensified gas-light, do away with the expense of maintaining some eighteen 16-candle power incandescent electric lamps which are now necessary for the illumination of the closets. The supply of gas to the installation is registered by a meter, so that the Board can judge for themselves the actual consumption and expense. There is no doubt that this is an experiment on the part of the Board; and from such trials as this, we look for a large extension of high-power gas lighting in the Metropolis and elsewhere.

PERSONAL.

Mr. JAMES BAXTER, the Manager of the Armadale, Linlithgowshire, Gas-Works, has, as will be seen from our Scotch Notes, been appointed Manager of the Forfar Corporation Gas-Works, in succession to Mr. Forbes Waddell.

The Directors of the Capetown District Water-Works Company, Limited, have presented Mr. THOMAS BENNETT, their Engineer, with a life-sized portrait of himself, painted in oils, as a mark of their esteem and regard on the transfer of the works to the municipal authorities.

Mr. GEORGE KEYTE, the Superintendent of the Shields Station of the South Shields Gas Company, was on Wednesday last the recipient of a very valuable clock and pair of bronze ornaments, presented by his fellow officials and the men of the South Shields and Yarrow works, upon the occasion of his marriage.

The Directors of the Great Marlow Gas Company, Limited, have appointed as Manager of their Works Mr. GEORGE W. WOOD, son of the Manager of the Maidenhead Gas-Works, in succession to the late Manager, Mr. J. Howse, who died recently. There were some 120 applicants for the post, in response to the advertisement which appeared in the "JOURNAL" recently.

OBITUARY.

We regret to announce the death of Mr. R. W. Ford, Clerk of the Peace of Portsmouth, which took place last Saturday week, at the ripe age of 78 years. Mr. Ford's career has been intimately associated with the progress of Portsmouth; but undoubtedly the great work of his life was his successful effort to secure for his native town the splendid supply of pure water that the inhabitants now enjoy. Had his advice been taken, the Town Council of 1854 or 1855 would have entered into the control of the water supply, which could then have been purchased for £42,000; whereas the price now would, it is calculated, be upwards of a million and a quarter sterling. The Council, however, refused to act on the suggestion; and the present Water Company was formed—Mr. Ford being the prime mover—with a capital of £80,000. He held the post of Secretary to the Company for 40 years; and on retirement was awarded his full salary (£500 per annum) by way of pension.

COMMUNICATED ARTICLE.

THE FUTURE OF LIGHT AND POWER DISTRIBUTION.

At the present time, when the Nineteenth Century has almost run out, and backward glances at the bye-gone eighteens are the fashion, it is interesting to each one to mark the changes that have taken place in the industries or professions with which he is either connected or interested. This searching of chronicles and records does not always prove pleasant reading; and it is not in all cases that bright prospects may be looked forward to in the future. According to whether the records of past years in a particular branch of business show a steady or a rapid improvement, a steady or a rapid decline, or a puzzling maze of alternating improvement and decline, so do the prospects of that business for the Twentieth Century appear as a bright flame, a dying glimmer, or a fitful flare. The electrical industry is one of the first class; and it probably will rank as the one which has had the most rapid growth and which has the brightest future.

The growth has not been limited to one groove, and is not of the soap-bubble type. It is universal and in practically all businesses and industries has it already been applied with some success. So general, indeed, has been its application, that it will be necessary for every man of the Twentieth Century—no matter what his trade—to know what electricity is and what it can do. It will be essential that, for any man to attain success, he must study electricity, and so learn how to make the best use of his time and his money.

To give a list of the many and varied uses to which electrical power has been put would be tedious reading, even if it were possible to obtain anything approaching a complete list. From the small fan for summer use in the drawing-room to the production of coal for winter use in the same room; for traction and other purposes above the ground, on the ground, and beneath the ground; for the production and purification of chemical materials, the breaking up, welding, and general manufacture and production of metal in all forms and shapes; in all classes of workshops, and in all pleasure resorts, theatres, and entertainments of every description—in fact, the difficulty is not to say where electrical power has been applied, but where it has not been applied.

It is of great interest to study the developments of trade by glancing over certain typical accomplishments, comparing the latest with those of previous years, and endeavouring to, as far as possible, see what is likely to be the outcome in that particular line in the future. In reviewing the greatest engineering work of power generating plants, one cannot fail to notice that, whereas the steam-engine of to-day—efficient and reliable as it is—is practically as it was ten years ago, other power producers have stepped to the front. The steam-engine used to stand out as the perfection of a power-producing machine; its long life, reliability, general adaptability, and comparative economy giving it this unique position. It has, however, remained as it was; while other rivals have come forward and now bid fair to eclipse the once so prominent steam-engine. No sooner had electricity come to be looked upon as a money-saver and form of power for every industrial purpose, and its safe and convenient transmissions over wide areas had been proved to be practical, than Nature (in the form of waterfalls) was set to provide the initial power.

This was the first trouble to the steam-engine. Many works, large and small, abandoned coal storage, boilers, and steam-engines, and substituted in their places compact electric motors, fed sometimes from works 40 miles distant. It was not only that an electric motor takes up less floor-space and requires so much less attention than steam plant, that caused it to come so readily into extensive use. The fine regulation of speed, the absence of stand-by losses on plant, the abolition of belts and counter-shafting in workshops and factories, and the cheap rates at which the electrical energy can be bought, are advantages occurring in every case. Of course, it can be well understood that there are certain industries for which electric power is particularly suitable—in places where continuous running and cleanliness are essential, in coal mines and powder factories, among other dangerous surroundings, and so on.

The use of water-falls and electricity did not, however, make very much difference to the steam-engine. Water-falls of any size are not too plentiful; and where water-falls are not, there steam-engines have been erected to drive the electric generators. No doubt this state of affairs would have gone along quite sweetly for many years to come, to the satisfaction of both engine-builders and electrical men, and it may even yet. That which is likely to change it is as yet only just born. It is the advent of a perfectly new type of gas-engine which is destined to work these changes.

The gas-engine which, it is claimed, is to work such changes, has been on the market for about two years. The principle of its operation and the details of its construction have been dealt with in so many technical and other journals recently, that it is almost superfluous to dwell upon its technical points here, since it is in its connection with the development of power schemes in the future that this article is dealing. It is sufficient to say that it is quite different in its main principles and in its working behaviour to any other type of gas-engine which has hitherto been produced. It can be made in the largest as well as in the smallest sizes. Several of 650-horse power have been in successful operation since its introduction. With regard to even rate of rotation, to accurate governing, and ability for long-continued stretches of running, it comes up to the best steam-engine practice. The floor-space required, as well as the fuel consumption per horse-power-hour are less in the case of the Westinghouse gas-engine than in the case so far of the very best steam practice.

These facts open up great possibilities of change in the power distribution world. When coal had to be burned for steam-raising for power purposes, it was necessary until within quite recent years to carry the coal about to the various boiler-houses of the works of the country, in order to distribute its energy. This method is now dying out, and we have large works wherein huge quantities of coal are burnt for steam-raising purposes, the steam driving engines which, in their turn, operate large electrical generators, from which current is transmitted over extensive areas to the various manufactories requiring power. This system has not yet had time to settle down to a standard state—its newness has not commenced to wear off; and day by day it still appeals to people in various parts of the civilized world as a piece of wonderful news. Will it ever come to be the standard method of power distribution, as steam-locomotion on metal-rail came to be the standard means of traction? It is doubtful if it ever will.

The coal as it is taken from the mine may be put through a gas-producing plant at once, on the spot; no carriage or cartage whatever being necessary. This gas may be used by engines driving electric generators, also fixed at the pitmouth, for distribution by high-pressure electric current; or the gas itself may be transmitted, at reasonably high pressure, through pipes over large areas, and utilized in small gas-engines at each works. In all probability a combination of the two methods would be best. Current generated at the pitmouth would supply the immediate neighbourhood—say, a circle of 20 miles radius; while at various centres beyond this, sub-stations would be erected. Each sub-station would be equipped with gas-engine and electrical plant, as at the coal pit; the gas being fed to each sub-station through a continuous length of pipe, from which the leakage would be very slight, and the risks of breakdown or interruption of supply would be practically zero.

The advantages to be gained from such a system can now be easily seen. The coal is cheaper, and yields more available energy per pound than when burnt or used in any other way for power production; the risks of interruption of supply are very slight; and the bye-products obtained from the gas-works are valuable, and still further reduce the price of a horse-power-hour.

The question so often asked in recent years, "How can gas companies meet the competition of electric companies?" may now be answered with certainty. When, taking into account the illuminating properties of gas and electricity, and the efficiency of dynamos and these gas-engines, it is found that gas companies could supply the same amount of illumination as before with about 40 per cent. of the quantity of gas originally required. To do this would only require the installation of suitable gas-driven electrical plant and electrical distribution.

The effects of such an arrangement will be manifold, apart from the cheapness of the supply, the lighting of dwellings and all buildings will be better, sanitary conditions especially will be improved by the electric light, the absence of numerous chimney-stacks, the general cleanliness and lack of overcrowding of men and plant in workshops and factories, refuse will be burnt for gas producing, and (in short) our towns will be clean and bright as the open country.

There are many other pleasing possibilities which will suggest themselves to the imagination when looking over the work which has been accomplished during the last few years. This is one in connection with electricity and gas. There are several others to be gathered from observation of these fields of industry and in almost all branches of work, so great and rapid have been the strides of general progress in this the latter part of the Nineteenth Century.

THE INTERNATIONAL GAS CONGRESS.

OPENING ADDRESS OF THE PRESIDENT, M. THEODORE VAUTIER.

Gentlemen,—In the name of the Organizing Committee of the Congress, I declare the first International Congress of the gas industry to be opened. The Organizing Committee thought it would be convenient to nominate as the "Bureau du Congrès" the Committee which it had chosen to give effect to the decisions taken preparatory to the Congress, and which, owing to this, had been for a year past in direct communication with the gas societies, members and representatives of which are here assembled. It has named as Honorary Presidents those who are at present acting as Presidents of the gas societies represented at the Congress; and as Honorary Members, those who were Presidents during the year 1899 to 1900, with whom the Organizing Committee were necessarily in close touch during the preparations for the Congress. In carrying out these nominations, the Committee had in view the allotting to all technical societies which have been kind enough to lend their valuable support, representatives in the "Bureau du Congrès," which could not be better made up than by those whom the societies had placed at their head. Secretaries of different nationalities have been arranged, in accordance with the wishes of the Presidents of the various societies. The "Bureau" thus made up will exert itself to the best of its ability to manage the affairs of the Congress; and it trusts to meet with your approval.

Gentlemen, I have first of all to state that the calling together of an International Congress of the gas industry, the initiative of which has been taken by the Société Technique of France, has received a most favourable welcome; the cordial eagerness with which the Technical Societies of different countries have replied to our appeal is an obvious proof of it. We have received more than 1100 promises of support, of which about 500 came from abroad. The presence among us of Presidents, of delegates, and numerous members of these societies (among whom are well-known personalities of the gas world), gives an exceptional character to this Congress, and promises its success; the number and the importance of the papers sent ensure the interest of it. It may be permitted me, then, to give expression of our sincere thanks to all those who have in different ways been good enough to support us with their valuable co-operation. We have also to thank the Administration of the Universal Exhibition for the useful help given us, and especially Professor Gariel, the Chief Engineer of the Ponts et Chaussées, and the principal delegate of official congresses, whose experience has been so valued by us.

If the representatives of the gas industry are assembled only now for the first time in an International Congress, it is not, however, from to-day that the tendencies date which have culminated in the calling together of a gathering of this nature. This desire has been shown at different times by reciprocal visits, when some among us have sought to render an account of the state of our industry beyond the frontiers of their own country, in order to keep themselves up-to-date with improvements of a practical character. It is, in fact, a widely-spread error to imagine that gas engineers have not worked much for the bettering of their industry. This error arises, no doubt, from a very superficial examination of our works, and from the fact that the fundamental operations which free the gas, by the very reason of their primeval simplicity, have not changed in any sensible degree.

Notwithstanding, what efforts and what ingenuity have not been expended for improving apparatus for the manufacture and utilization of gas! Our technical papers, and the minutes of our societies, give proof of it to those who would take the trouble to glance through them. Further, our engineers have always sought to benefit our industry by discoveries which have been made in others connected with it. In this regard, are not the application of regenerative heating for gas-furnaces, and the recuperation of intensive burners, remarkable examples, to cite no others? And has not our industry, which some pretend to be retrograding, in its turn opened up new ways by creating gas-engines, which have already rendered great services, and for which one sees dawning to-day an immense application in metallurgy, by the direct use of the explosive force of poor blast-furnace gas?

Another prejudice, of a different character, is still spread among the public. It is that the gas business has given extraordinarily favourable financial results, owing to excessive prices, which have weighed upon consumers. It is forgotten that many of these concerns have had initial difficulties; that even now, for some of them, the shares are worth less than their nominal value; and if, for others, the value is higher, it is not difficult to find industrial businesses, without monopoly, which have stock of which the worth is five or six times the nominal value, and which, in consequence, are otherwise favoured than ours.

Since the Exhibition of 1889, many attempts have been made to better the different branches of our industry. It would be out of place here to make even an approximate list of them; but it would perhaps not be without use to see in what direction they have been made. In the manufacture of gas, one of the questions which has most occupied engineers is the development of mechanical means of handling coal and coke. You know the principal solutions which have been devised to this end—charging and drawing machines, flap conveyors, horizontal chains, bucket elevators, waggon hoists, &c. The latest system for carrying coal is horizontal conveying by belts, combined with elevators. It includes a railway, flanked on one side by the coal-stores with inclined sides, and on the other by the retort-house. You will be able to see in the Champ-de-Mars an interesting example of arrangements of this class, due to the collaboration of MM. Rothenbach, of Berne, Weiss, of Zurich, and Giroud, of Olten. They are represented by a model of imposing proportions, exhibited by the Stettiner Chamotte Fabrik. Among other of the most recent applications which refer to these different processes, are the works of Geneva and of Zurich, designed by very competent engineers. Of the construction of these M. Weiss had charge; and concerning them he has published a very interesting pamphlet. But it is not given to many persons to have to build an altogether new works; and mechanical processes have had to be applied to the exigencies of the oldest works.

We shall see a very instructive example in coke-handling plant on the visit to the Clichy works to which the Paris Gas Company have very kindly invited the members of the Congress. The installations at Clichy form the subject of a very minute report which M. Louvel has been good enough to prepare, and which he will give us during this meeting. It would be interesting to compare the first cost of these mechanical systems with the economies arising from their use. It might thus be known what the productive power of a works should be to profit by their adoption.

In the construction of retort-arches, producers have thoroughly established their place, above all in works which have good coke sales. Their arrangement is less complicated now than it was at the beginning. It was first attempted to push to the uttermost recuperation, which was impossible without some complication. Now the use of simpler and stronger systems appears to compensate for giving up some of the heat.

The inclined retort, invented by M. Coze, with the modifications which practice has suggested in its use, continues a brilliant career. It is, perhaps, of all improvements which have arisen for some time past in the manufacturing plant, that which appears to have the most definitely won its place in our industry. We number in this Congress engineers who have built important installations of inclined retorts; and we hope that they will be good enough to tell us the results they have obtained.

Before leaving the retort-house, it seems to me that we have to regret not having an instrument for measuring in a practical way, and also registering, the temperature of the retorts. The platinum pyrometer, of M. Le Châtelier, is a very interesting apparatus, which has rendered real service, but the use of which necessitates superior knowledge to that which the retort-house staff possesses. The finding of a more simple apparatus would receive attention. We shall await with interest the paper which Mr. Alten S. Miller is to give us on this question.* Connected with this subject, is the important work which M. Euchène has prepared for the Congress, in the name of the Paris Gas Company, on the thermic reactions in the distillation of coal, and the determination of high temperatures.

I will pass over other questions connected with the manufacture, turning to mention the more complete washing of the gas, its slower speed in the purifiers, and chiefly the progress made in the way of absorbing cyanides and naphthalene, which will be treated by the author himself, Dr. Bueb, of Dessau, whose new researches have recently attracted our attention.† Dr. A. Smits, of Amsterdam, will also deal with this question.‡ Finally, I ought to remember the work of one of the Past-Presidents of the Société Technique of France, M. Mallet, who told us last year of the use of crude ammonia as manure, and as an effective agent for destroying certain insects harmful to agriculture.

It is above all in the apparatus used for lighting that the most marked progress has been made in our industry since the Universal Exhibition of 1889. At that time appeared, in all their brilliancy, intensive burners, which had already been invented some years. These burners constituted sources of light at once more powerful and more economical than former ones; for they gave intensities of 30 to 50 carcels, with gas consumptions of 40 to 30 litres per carcel-hour, while the ordinary butterfly burners required 125 litres, and those "à couronne" 90 litres. This important advancement was the result of the application (which we owe to Herr Frederick Siemens) of the principle of recuperation to gas-burners. The heating by the burnt gases of the air required for combustion, produced an increase of temperature corresponding to a considerable enhancement of luminous intensity. This, in fact, increases much quicker than the temperature, as has been shown by the experiments of Dulong and Petit, Stefan, Violle, and several other physicists. Recuperation was applied to the construction of burners of various forms, of which one of the most appreciated was that of Wenham, giving a reversed flame or luminant sheet, and other types which improved the public lighting—such as the Schulke, "Industrial" burners, &c. The use of these lamps permits of increasing five-fold (5·45 times) the amount of light thrown on to the ground by the butterfly burners (0·25 carcel per square metre), as resulted from tests made in Paris, and of

* See *ante*, p. 643. † See pp. 699, 700. ‡ See p. 701.

giving a light of the same character as that from the electric arc lamps.

These results, already sufficiently interesting, were soon, however, to be greatly surpassed. A radical change was about to take place in the way of utilizing gas combustion. Returning to an idea which was the germ of the Drummond light, and which was also seen in the burners of Frankenstein, Caron, Tessié du Motay, Clamond, and others, and abandoning illuminating flames for blue flames, Dr. Carl Auer von Welsbach adapted the combustion of gas by the bunsen burner to the increase of temperature of the mantle of which he is the famous inventor (1885). Some years later, Dr. Auer brought his mantle to a pitch of perfection which gave it a great impetus. The beautiful and brilliant light which it affords, combined with the economy of its use, ensures for it a success without precedent in our industry. The Auer burner gives to towns or to individual homes a light of varying powers according to the different desires of the consumers, from the B B burner of 1 carcel up to the No. 3 of 12 carcels, and even up to the 25 carcels of recent types.

The Denayrouze, Bandsept, and other burners, which are convenient variants of it, have not been less appreciated. Several of these systems have, besides other advantages, that of doing away with glass chimneys. However, incandescent burners only give their full effect under pressure greater than 25 mm. of water. But for some time past there have been made bunsen burners working very well with the lowest pressures that are usual in towns. M. Lecomte has devised one of the most advantageous burners from this point of view, for which a pressure of 20 mm. is enough. The Auer and the Denayrouze Companies have also made bunsen burners enjoying the same advantages.

Alongside of the comparatively high pressures which are expedient in certain cases, further progress has been made. There are burners which, with a pressure of about 100 mm. of water, give 20 to 30 carcels each. By grouping two or three together, the lighting intensity of arc lamps of 12 ampères is largely surpassed. This result may also be attained without increased pressure, by grouping five or six ordinary incandescent burners, consuming 160 litres per hour. Lastly, I leave M. Salzenberg, Engineer of the Municipal Works of Crefeld, to speak to you of the light which he obtains by using gas compressed to 1 atmosphere with a mantle of special form invented by him.

I ought also to draw your attention to the incandescent lighting as arranged by the Paris Gas Company in the walks of the Champ-de-Mars and of the Trocadéro, the total power of which is 100,000 carcels; 60,000 being given by 3300 mantles supplied with gas at ordinary pressure, while 40,000 carcels are from 1700 mantles, burning gas under a pressure of 200 mm. Those in the Champ-de-Mars are Auer mantles with Bandsept burners;* those in the Trocadéro are Denayrouze models. M. A. Lévy has been kind enough to draw up a description of this installation for the Congress. This brilliant lighting has been a great success with the public; and I trust to be interpreting your wishes in congratulating the Paris Gas Company on having made so dazzling a demonstration of the resources of our industry.

The public may find among the varied apparatus for incandescent lighting, different types corresponding to its needs. Also, it has promptly taken note that, by adopting incandescent burners, it has much more light with much less expense than with former ones. The intensive regenerative burners give a carcel-hour for 40 to 50 litres; while incandescent burners give it for 12 to 17. Although the use of these burners is very widespread, one may predict their still more general adoption—above all in those countries where the mantle is a protected article, but which protection will soon cease. The price of Auer burners, which varies in France from 12 frs. to 14 frs. will be able to be reduced apparently to about 3 frs., according to the offers which have recently been made by different makers. The mantles, the present price of which is high, would be sold at 0·40 fr. The public may thus soon realize all the economy resulting from incandescent gas.

This lighting will be spread, moreover, among habitual users of gas. It appears, also, as likely to be adopted by a *clientèle* hitherto difficult to get at; and our industry may thus hope for some compensation for the partial loss incandescence has caused. If we are able to state the notable progress which incandescent mantles have brought to gas lighting, we do not know completely the causes to which are due the brilliant light they produce. Different explanations have been given, among which I call to mind those of Dr. Bunte, to whom we already owe so great a number of notable researches on questions which interest our industry. The author established, first of all, by a clever experimental inquiry, that it is not necessary to look for the cause of intensive lighting effect in the specially high emissive power of rare earths and their mixture. Besides, we know that mantles formed only of pure oxide of thorium or pure oxide of cerium have very feeble illuminating power, while mantles made up of a mixture of 99 per cent. of oxide of thorium and 1 per cent. of oxide of cerium give a brilliant light; and that, in fact, the proportions of this mixture cannot be varied even slightly without considerably altering the result.

Following our author, the oxide of thorium which, after calcination of the nitrate, presents itself in the form of swollen and porous filaments, serves as a large surface for carrying very fine particles of oxide of cerium, of very small bulk, weak in calorific capacity and conductibility, and which may thus be carried to a very high temperature. Their brilliancy, therefore, becomes very great; because the luminous intensity of the incandescent bodies increases much more rapidly than the temperature. According to MM. Le Châtelier and Boudouard, it would follow simply that, coloured bodies having a law of radiation more favourable than dark bodies at the same temperature, which is about 1650°, the emissive power would be near the unit for blue, green, and yellow radiations, and much more feeble for the red and heat radiations. Dr. Bunte shows, moreover, that oxide of cerium lowers to about 300° the temperature of the combining of oxygen and hydrogen; and he thinks that this property plays a part in the phenomenon. He sees something analogous to what is obtained with platinum, the incandescence of which can be maintained by a current of cold air—a property of which surgeons have taken such convenient advantage. Dr. Bunte will address us shortly on the photometry of incandescent bodies.* While we are speaking of incandescence from the point of view of the laboratory, it may be permitted me to express the wish that an international understanding may be arrived at for settling the rules to be followed in determining the value of mantles. While keeping to the usual procedure adopted in each country for actual photometrical measurements, there might be arranged a certain number of precise rules which would make comparable tests on mantles. In how many vertical angles should the intensity be measured; how many photometrical tests should be made to determine the average value; how should correction be made for comparing the ascertained figures with standard gas, and of different calorific power with the corresponding value of a defined gas? These questions and many others which are connected therewith should be decided by a common agreement before anyone has formed customs which it would not perhaps be easy to alter in the future.

The great development of incandescent lighting which seems probable when the next reduction of price shall have taken place, has led some of our colleagues to ask if, in the near future, it will not be altogether substituted for illuminating flames. In this case, it would be the calorific power of the gas which would become the preponderating element in its value for all uses. This does not mean to say that ordinary gas will of necessity have to give place to different poor gases; because ordinary gas of the normal standard contains double the calories of uncarburetted water gas, the most calorific of poor gases. On this hypothesis, would there be, or not, an economy from the use of one or other of the gases, or of their mixture in certain proportions? It is, indeed, a difficult question to settle in a really precise way; for its solution rests on a great number of data, several of which might be absolutely false, owing to the state of things that would follow the exclusive use of water gas—particularly variations in the price of coke, ordinary gas coals, and bye-products.

The most recent publication that I know on this subject is that by Herr Schaefer, Engineer, of Dessau. It shows that the production of water gas is far from being as economical as is often supposed. The cost of water gas, such as is sometimes given, is that which results from the actual manufacture. It is not a net industrial price—that is to say, burdened with all the charges which it would really have to bear in normal working for a certain length of time. If these considerations are taken into account, I am convinced that the net price of water gas would not be less than that of ordinary gas, without mentioning the inconveniences it entails, from a sanitary point of view, owing to the high amount of carbonic oxide which it contains. It appears, according to some views, that the manufacture of gas from coal is only made imperative in order to satisfy the standard of illuminating power. This idea seems to me too exclusive. The illuminating hydrocarbons only form 5 or 6 per cent. of ordinary gas; and 92-100ths of the remainder are made up of hydrogen, carbonic oxide, and marsh gas. With equal volumes, hydrogen and carbonic oxide are found to have very nearly the same heating power—that of marsh gas being something like three times as much; and as this gas is itself one-third of the total volume, it is seen that the use of coal gas procures not only the standard required, but also a considerable amount of heating power. It results from this, that if the illuminating hydrocarbons are suppressed by a suitable process, the gas loses its standard, but preserves about 93 per cent. of its heating value. This it is which explains the result of certain experiments in which the intensity of the light given by an incandescent burner varies but little, whether it is supplied with ordinary or uncarburetted gas. But such a gas is not the direct product of normal distillation I do not think that there is in this result an irreducible contradiction with the interesting facts which M. Aguitton published in 1893, showing that ordinary gas has a heating power proportional to its standard in the Bengel burner. When the gas is burnt in the Auer burner, the luminous intensity decreases at the same time as the standard—a loss correlative to that of the heating power. This last result appears to me to be due, not only to the decreasing proportion of illuminating hydrocarbons —the ethylene, acetylene, and benzene, the combustion heat of

* In this connection, it is only right to point out a slight mistake in our abstract of M. Lévy's paper last week. The consumption of gas in Bandsept burners was stated as 1350 litres, giving 35 carcels. The consumption should have been 350 litres—the error occurring through the "1" placed before the 350 in the original to represent the word "litres."—Ed. J.G.L.

* See *ante*, p. 642.

which is very high—but perhaps still more to the marsh gas, the proportion of which diminishes in general with that of the hydrocarbons, such as is noticed chiefly when the time of carbonization of the same coal is increased. M. St. Claire Deville has made a classification of the best coals for gas making. His analyses concern five different types. They show that the proportion of marsh gas and illuminating hydrocarbons varies at the same time, and in the same way; while that of hydrogen varies in a reverse manner. The correlation existing between the standard and the heating power of the gas is thus corroborated. With these reservations, I do not deny that some advantage may be found in the use of coals giving less lighting results than ordinary gas. A preliminary experiment should be made, so as to regulate the incandescent burners for a gas of such a character, and to find out the result. As regards carburetted water gas, used in a more or less restricted way, according to the countries and the prices of material used for carburetting, it appears of late to have had rather more attention given to it, at least in Europe, since there has been more facilities given to enriching by benzol. It seems to be able to render some service in our works, as auxiliary to the manufacture, by mixing it with ordinary gas in proportions which depend on the maximum amount of carbonic oxide allowed by the authorities. In Germany, the mixture may contain up to 30 per cent. of water gas; in England, a little more. You will have an interesting report from M. Sospicio, of Trieste, on this subject, and from Herr Dicke on the Dellwik-Fleischer process.

The carburetting of ordinary gas by benzol has given results which tend to generalize this method of enrichment. Some years ago, when carbide of calcium was prepared on a working scale by the system of M. Moissan, it was asked if the use of acetylene as a carburetter would not be advantageous. Experiments were made which proved satisfactory from a technical point of view; but they showed that acetylene was dearer than other carburetters, when the price of carbide of calcium of good quality exceeded 200 frs. per ton delivered at the works.

We should not pass by in silence the trials made about fifteen years ago for improving domestic heating by gas. Since then, a very large number of arrangements have been placed before the public. Practice has shown that there is every interest to produce the greatest possible amount of directly radiant heat by means of suitable surfaces made incandescent by the combustion of gas—such as, for example, refractory bricks covered with asbestos, arranged vertically, so that the blue flames of the stream of gas just touch it. On these lines, which our knowledge shows us to be the most rational, it may be foreseen that arrangements and materials will be found giving still better results by increasing the temperature of the incandescent surfaces. The heating of the primary air, without doubt, contributes to this to a certain degree. Also recuperation is applied to a large part of the apparatus. But there is a limit which is not to be passed, either to avoid complication in making or to leave for the chimney the required amount of heat for a proper draught. It seems to me that if it was not for the fragility of the mantles, the application of physical laws would lead us to grouping a larger or smaller number of incandescent burners without glass, to get a gas-fire of very good power. The systems using the white combustion of gas have also shown certain advantages. However that may be, it may be stated that very great progress has been made in this department, and that the public now have a very choice variety of types of burners giving good results, the advantages of which they will appreciate more and more, especially if the firms who place these stoves in the houses give as much care to this department as is taken in their manufacture.

Cooking by gas opens for our industry a market still more important than heating. The many advantages which it gives, assure its receiving increasing favour. The question of domestic heating and cooking by gas will be treated in the name of the Paris Gas Company by M. Auguste Lévy, who has been kind enough to prepare for the Congress a very detailed report, in which are given the scientific methods followed in the construction of the apparatus, in the verification of the hygienic conditions of their working, in the ensuring of complete combustion of the gas, and in the determination of the heating result. Comparing this work with the book published by M. Auguste Lévy on "The Gas Industry at the Exhibition of 1889," the ground covered since then will be seen. The progress made in this respect outside of France has not been less interesting. M. Ad. Bouvier has given a review of it as regards Germany in a report on the Industrial Gas Exhibition at Berlin in 1896, undertook by him on the initiative of the Société Technique.

I pass on to gas-engines, concerning which M. Aimé Witz will speak to us with the authority which he has acquired by his well-known work in France and abroad. He will show us that for certain powers, the gas-engine has nothing to fear from any other competitor, even with ordinary coal gas at 20 c.; and he will describe engines of 500-horse power of the Cockerill Society which may be seen at work in the Belgian Section. Twenty years ago, the most powerful gas-engine was of 60-horse power, with two cylinders of 30-horse power each. Herr von Oechelhaeuser, whose energy is so largely spent in researches relating to our industry, will permit me to associate his name with those of other engineers who have contributed to these important results.

Among comparatively recent apparatus connected with the consumption of gas, I may mention prepayment meters, which have rendered services more or less great according to the localities and the character of the *clientèle*, as well as automatic lighters, which are also of importance.

Among the industries which compete with our own, electricity is the one which calls for our greatest attention, and also our interest, because there are not wanting examples of gas-works and central electrical stations united under the same management. It even seems as if gas companies show a more marked tendency than formerly to combine the working of electricity with that of gas. I do not affirm that each of these associates conduces in the same degree to the prosperity of the common enterprise. It is, indeed, a question of internal policy, into which I will take care not to enter.

One of the most salient facts of recent years in electrical lighting is the practical working of incandescent lamps at 220 volts, the adoption of which offers several advantages, among which one of the most appreciable is the increase in the distributing power by the same system. The decrease in the consumption of carbon by arc lamps deserves to be noticed; but it is only obtained by arrangements which weaken the intensity of the light. The Nernst lamp, which you can see in the German Section, has not yet been endowed with an automatic lighting sufficiently sure and practical to allow it to take an important place among electrical appliances.

Of the papers read at the International Congress of Electricians, which met in Paris at the end of August, one of the most noteworthy was from Madame Herta Ayrton, on the luminous intensity of the arc on continuous current. Madame Ayrton showed that, with equal current, a space of 1 millimetre between the carbons gives the maximum intensity. An arc of 2 millimetres is much less good. The 1 millimetre arc gives, not only the most light, but also the best return. The proportion of the luminous intensity to the power developed by the generator is greater for an arc of 1 millimetre than for that of 2. The author, however, did not say in what proportion. There would be, then, every advantage by using the arc of 1 millimetre and currents of great intensity, because, with weak intensities, a too great portion of the light would remain, so to speak, shut up between the two carbons, owing to their position. The paper contains ingenious views on the causes of the weakening of the luminous intensity due to an increasing space between the carbons, principally the formation in the gaseous arc of a mist of solid particles of carbon, coming from the very rapid cooling of its vapour, at short distance from the crater. This thesis is very interesting; but it may be asked in what way will be realized a commercial apparatus allowing the maintenance with sufficient regularity of so small a space as 1 millimetre between the carbons.

In electrical distribution, the continuous current seems generally more appreciated than the alternate current of one or two phase; and the most recent tendency is to distribute at 500 volts on three wires, since there are good lamps at 220 volts. Several advantages are claimed in favour of the continuous current—chiefly the facility of starting motors, scattered through a district, the best result with arc lamps, and the least loss of energy on a system destitute of fixed transformers, which are onerous when they do not work at full charge. On the other hand, the triphase alternative system makes up for it by the carrying of energy a great distance on aerial lines at high tension. It is one more resource for using natural motive forces in cases where the establishing of these forces is not counterbalanced by the economy accruing therefrom. The continuous current at high tension has also lately been used for the distribution of energy on aerial lines traversing different localities. Each of them has a receiving machine worked to drive transformers, and all the receivers are in series on the line. It may be questioned to what extent it would be wise for the lighting of a town of any importance (so necessary for its safety) to depend on the interruption of a line traversing such distances, where proper superintendence is impossible, and which is at the mercy of a storm. The same remark applies also to the triphase current. But beyond this special case, these new systems, capable of numerous applications, may be considered as one of the most interesting triumphs of modern science, and augur well for new resources which they promise to the industry.

Acetylene does not appear to attract much attention from gas engineers, if one may judge from the publications of different technical societies. The activity of the supporters of this light is shown chiefly in the construction of a very great number of various apparatus, serving to free the acetylene from the carbide of calcium. To produce the light of a candle, there is required 0·66 litre of acetylene, or 1·5 litres of ordinary gas. The proportion of these volumes is 1 : 2·27; but acetylene costs from ten to about twelve times more than gas. Thus, how much inferior acetylene is to coal gas from the economical point of view may be seen. If, in addition, it is remembered that acetylene is not practically useful for heating, nor for motive power, it will be seen that a town supplied exclusively by acetylene would be deprived of a distribution of heating and motive power, at the same time adopting a light much more costly than gas. Consequently, there are only a small number of localities, and those of little importance, having a distribution of lighting from central works. The efforts first tried (without success) for supplying gas-engines with acetylene, do not seem to have been resumed. Finally, some companies manufacture oil gas for the

lighting of railway carriages or tram-cars mixed with acetylene in certain proportions.

Some new processes allow of compressing acetylene in very strong steel vessels, filled with porous bricks saturated with acetone, in which it dissolves. These vessels may be taken to the houses, and give a certain number of hours' light, after which they are returned to the works to be recharged. There is in this a future industry analogous to that of portable gas. The Society of Metallic Carbides who own the Bullier patents, have obtained judicial acknowledgment of their validity.

Besides lighting distributed from some central works, there are a certain number of recent processes which have been more or less noticed. Among these, the attempts made to produce the incandescence of mantles by means of petroleum have not given sufficiently practical results. The use of alcohol for this end does not appear reasonable, owing to its poor heating power compared with that of petroleum or illuminating gas. A litre of medicated alcohol and a cubic metre of gas give the same amount of heat. Incandescence by alcohol at 0·60 fr. will cost generally 2 to 3 frs. more than gas at 30 c. or 20 c., without mentioning the complication and high price of the apparatus. The supporters of alcohol have also tried a return to illuminating flames, using alcohol carburetted with benzene or similar hydrocarbons, into which mixture a wick plunges carried by a burner like that for ordinary petroleum lamps. Even if this system becomes practical, I do not think we shall have to regard petroleum lighting from the point of view of competition. It is rather the petroleum industry that would be attacked; because it is understood what interest the countries producing alcohol and importing petroleum would have in seeing the consumption of petroleum diminish to the advantage of a national product. I will not dwell further on these various systems, on which M. Lecomte, of Paris, will shortly speak to the Congress.

Commercial heads know how much it behoves them to have under their orders a sufficiently reliable and instructed staff. It is not enough to find technical improvements or good commercial processes. It is necessary to entrust their application to workmen and employees capable of taking their part, and of making them produce their fullest effect. The auxiliaries of this class must be more numerous in our industry. Even in the countries which have most developed professional teaching in general, they seem to have rather neglected—except in designing and in the offices—to establish suitable courses for preparing the staff for the different services of our enterprises. Yet certain industries have obtained by these means very encouraging results. Why should it not be the same for ours? As such instruction could only take place in the evening, it is quite obvious that the workmen who follow it are those who are willing to be taught, and who will have, two or three times per week, to conquer the fatigue of a day's work. And there would be more than one might believe, if I may judge from what I have seen for a long time at Lyons at the Society of Professional Instruction for the Rhone, where, with persistent success, more than 200 evening classes take place, among which are a certain number concerning manual labour. This organization is offen referred to, as it has attracted the attention of both strangers and French who have studied its working. I do not mean to say that other systems would not conduce to the end of which I speak; but what I believe is desirable above all is that we should occupy ourselves more with considering it. In this connection, I draw your attention to a report which Mr. Alfred E. Forstall has sent to the Congress on the Educational Fund, founded by the American Gaslight Association, on the initiative of Mr. Clark. Mr. Clark wished to establish a system of supplementary instruction for the many young men who, without having the advantage of advanced teaching, exerted themselves, when employed in subordinate positions in our works, to become capable of occupying posts involving greater responsibility. He has organized what may be called a school by correspondence—that is, the sending of a certain number of questions to answer to all those who have joined it, and the books to consult for the solutions. The exercises are then corrected, and afterwards returned to the pupils. The results obtained are so encouraging that the American Gaslight Association have decided to give yearly a sum of 20,000 frs. to the management of this school, and to the remuneration of a person employed in the sending and correcting of the exercises for the pupils, who number about a hundred. If such an organization—which has the advantage of reaching persons scattered in different towns—has produced such satisfactory results, may not still more be hoped for by the founding of professional classes, where the scholars are more directly and more frequently under the teacher? On the same lines, we have the City and Guilds of London Institute, and the Plumbers' School, which Herr von Oechelhaeuser had the intention of establishing at Dessau, and of which we hope he will be good enough to tell us something.

In some gas-works efforts have been made to interest the stokers in the retort-house work. Therefore an inquiry into the different means employed for this end is particularly opportune, and I thank M. Hedde for having been kind enough to prepare it for the Congress. I trust that it will give rise to other information on this subject from those of our colleagues who are interested in it.

I will not attempt to speak to you of what there is to be seen in the Universal Exhibition concerning our industry. I have already told you of the lighting of the Champ-de-Mars and of the Trocadéro, carried out by the Paris Gas Company. There is, besides, the Gas Pavilion which has been built by the aid of subscriptions made by different Companies or persons attached to our Société Technique, and by the Paris Gas Company. To show the varied and numerous ways of using gas, to bring together appliances of different types, to fit them up in places appropriate for their use, to thus take away from the public the confused impression too often caused by shows, to arrange, for example, three or four types of dining rooms, bathrooms, kitchens, &c., for flats more or less considerable, so that each can take account of the advantages of the use of gas. These have been the main ideas on which the programme was arranged by the Committee of our Société Technique. It is M. Eugène Lebon, the doyen of our Past Presidents, who has kindly taken upon himself this work.

Gentlemen, I have not the intention, in this rapid survey, of speaking of all the interesting things which have been brought out in our industry since the Universal Exhibition of 1889; nor to cite the names of all those who have taken useful initiatives therein. I have only been able to skim very imperfectly the facts which seemed to me most salient. They form, nevertheless, a brilliant and rich harvest which bears witness to the vitality of our industry and the importance of the works of its representatives in different nations. They permit of our looking at the future with the confidence belonging to men who have valiantly struggled, who have known how to defend their positions, and who march always in the front.

A METHOD OF PREVENTING NAPHTHALENE OBSTRUCTIONS.

By Dr. Bueb, of Dessau.

[A Paper read before the International Gas Congress at Paris.]

Naphthalene occurs among the various hydrocarbons which are formed in gas-retorts during the distillation of coal; and it is in very ill-repute among gas engineers.

Naphthalene is found in the form of a very volatile solid, which condenses, for the most part, on cooling in the condensers, together with the tar. This simultaneous separation of tar and naphthalene, however, is not a complete one; and a certain proportion of naphthalene always remains in the state of vapour in the gas from which the tar has been abstracted. This volatile condition of naphthalene is responsible for its deposition in the form of superposed scales, under the influence of a slight depression of temperature or of some small obstruction in the mains. A very small weight of this deposit is sufficient to rapidly obstruct the mains—even those of large diameter—to such an extent that a tangible loss of capacity ensues. Such are the naphthalene obstructions which are familiar to every gas engineer, and which constitute an extremely troublesome impediment to the working.

For many years, means of getting rid of this naphthalene nuisance have been studied. All attempts to prevent its formation in the retorts have completely failed. In the next place, attempts were made to discover methods having for their object the absorption of the naphthalene after it had been formed. Among ideas of this nature ought to be mentioned the method of Bunte and Eitner (see "Journal," Vol. LXXIII., p. 437), which consisted in mingling vapour of xylene with the gas. The xylene vapour, when it assumed the liquid state, dissolved deposits of naphthalene which had been formed.

Researches in the direction of removing naphthalene from the gas on the works had no further practical outcome until quite recently. Attempts had been made in vain to retain it by a sudden depression of temperature brought about by the introduction of steam. Other processes, such as Erdmann's, which consisted in abstracting the naphthalene by means of picric acid, which formed an insoluble picrate with it, did not answer in practice on the works because of their complexity and the magnitude of the cost of their application.

A method which has been industrially applied at the large works of the German Continental Gas Company, at Dessau, may now be described. By its means naphthalene can be abstracted from illuminating gas on the gas-works in a simple and inexpensive manner. The principle of the process consists in bringing the gas as it leaves the Pelouze and Audouin tar extractor into intimate contact with a tar oil of very high boiling point. Anthracene oil, which boils between 480° and 750° Fahr., has afforded the best results. An oil of this description possesses the property of absorbing as much as 25 per cent. of its weight of naphthalene, according to the temperature. Nevertheless, since this oil likewise possesses the property of dissolving a small amount of illuminating hydrocarbons—such as benzene and toluene—it would, if employed in its natural condition, cause a diminution of the illuminating power of the gas. Inconvenience on this account is, however, completely overcome by adding to the anthracene oil (before use) 4 per cent. of its weight of pure benzene.

The process is applied in the following manner: Two or three compartments of a "Standard" washer are filled with the oil in question; and the gas is passed through these compartments until the oil in the first one is saturated with naphthalene. In order to ascertain the degree of saturation of the oil, a distillation test is made. The oil may be regarded as saturated when the distillate collected at 518° Fahr. sets in the receiving vessel.

The absorptive power of the oil increases as the temperature rises. At 77° Fahr., it absorbs about 19 per cent. of its weight of naphthalene. In order to indicate with how great an intensity the absorption takes place, the following results of analyses made on the three compartments in succession are given. The first compartment of the "Standard" washer had absorbed 92½ lbs. of naphthalene when 1,766,000 cubic feet of gas had passed through it; the second compartment, 37½ lbs.; and the third, only 1½ lbs.

In order to work the process, it is not absolutely essential to employ a mechanical washer. Any washer provided with a pump which will serve to maintain a continuous circulation of the oil, can be adapted to work the process; but a mechanical washer is greatly to be preferred.

The cost of applying the process is naturally dependent on the price of the oil used. But as the oil is one of the crude products of the distillation of tar, its price (inclusive of that of the 4 per cent. of benzene) cannot generally exceed three times that of the crude tar; and as the oil after saturation can be freed by distillation from the naphthalene it has absorbed, it can be thus again rendered fit for use to absorb more naphthalene. With large installations, it will generally be most advantageous to regenerate the oil on the spot; but this must depend on the contractor's terms.

The amount of naphthalene in gas is greater, the higher the temperature. For instance, in works where, summer and winter, the temperature of gas as it issues from the Pelouze tar-extractor keeps at about 77° Fahr., the proportion of naphthalene will be about 1 oz. per 1000 cubic feet. The outlet of the tar-extractor is where the absorption of the naphthalene ought to be effected. After the gas has passed through the naphthalene washer, it will be divested of naphthalene to such a degree that there need be no fear of subsequent deposition of it in the mains.

THE PRODUCTION AND MANUFACTURE OF CYANIDES IN GAS-WORKS.

By Dr. Bueb, of Dessau.

[A Paper read before the International Gas Congress in Paris.]

It has long since been recognized that illuminating gas contains cyanogen, as well as sulphuretted hydrogen and ammonia. Even in 1850, in the specification of an old English patent, allusion is made to the fact that cyanogen is always present in gas. Nevertheless, having regard to the comparatively limited proportion of cyanogen in the gas, and to the lack of knowledge at that time of its practical utilization on a large scale, its extraction by special means was, almost without exception, not undertaken. All that was done was to extract from the gas that portion of the cyanogen which was deposited as blue in the purifying material.

Cyanogen was actually found in the gas as hydrocyanic or prussic acid (HCN) in the free state. Washing this prussic acid, by means of water, with the ammonia of the gas, does not, however, allow of its extraction in the form of readily soluble ammonium cyanide; for the carbonic acid, which is always in excess in gas, immediately decomposes the ammonium cyanide produced into ammonium carbonate and free prussic acid. This reaction accounts for the ammoniacal liquor of gas-works being free from ammonium cyanide.

On the other hand, the ammoniacal liquor always contains another compound of cyanogen—viz., ammonium sulphocyanide—which salt is formed in the washers by chemical reactions between the hydrocyanic acid, the ammonia, and the sulphuretted hydrogen present in the gas. Only a small portion, however, of the cyanogen is thus combined; the greater part does not enter into combination, and is carried forward by the gas into the purifying plant.

Only there does chemical combination of the cyanogen take place. In the purifiers, the cyanogen combines, on the one hand, with the oxide of iron of the purifying material and with the ammonia which is still present in small quantities in the gas, and forms therewith insoluble ferrocyanides; and, on the other hand, it combines with sulphur compounds present in the gas, with which it forms sulphocyanides, that gradually accumulate in the purifying material. The absorption of the cyanogen in the purifiers is not, however, complete. There remains a more or less considerable percentage in the purified gas; so that, in works where cyanogen is not specially extracted, an appreciable amount is actually always to be found in the gas as distributed to the consumers.

Until about the middle of the year 1880, the purifying material, after use, was only a waste product of no value to the gas-works; but at that period the employment of cyanide of potassium in gold extraction gave a new aspect to the problem. Cyanogen products thenceforth had a vast arena for employment; and all substances containing cyanogen became of great interest industrially. In this manner, the purifying material from gas-works came into demand; and now, on account of the prussian blue which it contains, it must be classed among the valuable bye-products.

Researches were then made on gas-works with the object of recovering as much as possible of the cyanogen which is not retained by the purifying material. To do this, it was necessary to find special methods for extracting the cyanogen elsewhere than in the purifiers. The procedure to be followed was pointed out in the old patents of Knublauch and of Rowland. These two processes aimed chiefly at the formation of a soluble ferrocyanide; and at some works in England the method was practically applied. The economical results were not, however, such as to warrant an extension.

Meantime, I was successful in devising, at the Dessau Gas-Works, belonging to the German Continental Gas Company, another method of extracting cyanogen from illuminating gas. It was a far simpler method. The principle of the process is the elimination of cyanogen by the aid of the ammonia present in the gas, by intimate contact with a concentrated solution of an iron salt, and the formation thus of an insoluble double salt. Practically the process is carried out in the following manner: The gas, immediately after it leaves the Pelouze and Audouin condenser, is passed into a special mechanical washer of the "Standard" pattern. This apparatus comprises four or five separate compartments, which are traversed by the gas in the reverse direction to that taken by the solution of the iron salt. The chemical reaction which takes place is as follows: The last compartment of the washer (*i.e.*, the compartment from which the gas leaves the apparatus) is filled with a freshly prepared concentrated solution of sulphate of iron in water. After six to ten hours, during which the gas is passing through, the sulphate of iron is completely converted according to the following equation:—

$$FeSO_4 + H_2S + 2NH_3 = FeS + (NH_4)_2\,SO_4.$$

The sulphate of iron is thus converted into an equivalent quantity of sulphide of iron; and the filtrate no longer contains iron, but consists essentially of a solution of sulphate of ammonia. When this reaction is completed, the mixture in the compartment in question contains only traces of cyanogen. The contents of this compartment then pass into the next compartment, in which another change takes place. The ammonia and the cyanogen of the gas form with the sulphide of iron an insoluble double salt of ferrocyanide and ammonium, while the sulphuretted hydrogen again becomes free, and is partly carried by the gas out of the washer and partly left in the product of the reaction as sulphide of ammonia. The following formula shows the chemical reaction:—

$$2FeS + 6NH_4\,CN = (NH_4)_2\,Fe_2\,(CN)_6 + 2\,(NH_4)_2\,S.$$

This reaction continues in the remaining compartments up to the last one, by which the gas enters the washer, where it is complete.

The effect of the cyanogen and ammonia on the sulphide of iron, which is formed in the first instance, becomes apparent in the colour of the liquid in which the reaction occurs. In the first compartment (in which is the solution of sulphate of iron), the liquid is deep black; in the following compartments, proceeding towards the gas inlet, this hue gradually gets lighter; in the last compartment it becomes yellowish green.

The product, as it leaves the washer, is a liquid mud, which is either sold in that condition, or subjected on the works to another change. This mud or sludge, as it leaves the cyanide washer, contains cyanogen in amount equivalent to about 20 per cent. of yellow prussiate; while the ammonia present in it varies between 6 and 8 per cent. (*i.e.*, the sludge is ammoniacal liquor of from about 27 to 37 "ounces" strength). The ammonia which has not been utilized in the absorption of cyanogen passes through the cyanide washer, and should be absorbed as hitherto by the special ammonia washer. Clearly this process lightens the work of the ammonia washers.

It may be added that the absorption of cyanogen, according to the above method, need not take place at a fixed low temperature. On the contrary, the reaction occurs with even greater vigour in the warm, with gas which has not been cooled. Consequently, in planning new installations it is beneficial to put the water or tubular condensers on the outlet of the cyanogen washer, and to connect the latter to the outlet of the Pelouze tar-extractor.

Proceeding now to the working up of the sludge. It is boiled until the uncombined or free ammonia is distilled off; the distillate is condensed in a condenser to ammoniacal liquor containing 5 to 6 per cent. of ammonia (*i.e.*, of about 25 "ounces" strength), or it is mixed with the works' ammoniacal liquor. The sludge which remains in the still then consists only of a mixture of an insoluble double salt of ammonium cyanide and a solution of sulphate of ammonia. It is transferred to a filter press. The liquid expressed is merely a 10 per cent. solution of sulphate of ammonia, which is suitably evaporated to make sulphate of ammonia fit for the market. The cake which remains in the press contains about 30 per cent. of prussian blue, and 44 per cent. of yellow prussiate; and it is saleable in that condition.

Sulphate of iron is the only chemical product required for the application of this process; and, as it is readily obtainable everywhere, the process becomes peculiarly simple. For every 100 lbs. of prussian blue recovered, 200 lbs. of sulphate of iron are needed. The apparatus likewise requires only the simplest attention—say, from one to two hours' time per diem according to the gas passed through it—spent on filling, emptying, and recharging the compartments of the washer. The yield obtained by the process depends primarily on the quality of the coal employed, and secondarily on the temperature of carbonization.

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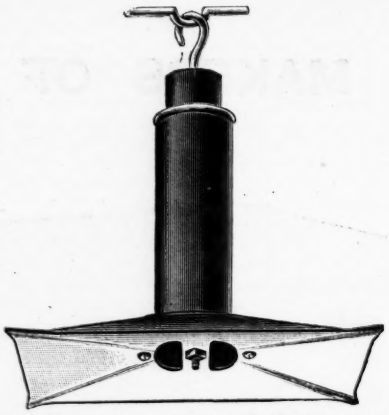

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Experience shows that English coals contain the most cyanogen. For instance, at one works where only English coals are carbonized, the mean quantity of cyanogen recovered by the sludge corresponds to 7·4 oz. of yellow prussiate per 1000 cubic feet of gas. Another plant, where a mixture of English and Upper Silesian coals is employed, shows a yield of 6 oz. per 1000 cubic feet. A works where only Silesian coal is carbonized obtains about 4·2 oz. Coal from the Saar basin gives a yield of from 4 to 4·5 oz. per 1000 cubic feet; while coal from the north of France gives 4 to 5 oz., and that from the east about 4 oz. In general, it may be taken that the minimum production on a gas-works will be 3·5 oz., and the maximum 8 oz. per 1000 cubic feet of gas.

The direct advantages offered by the process are the simple extraction at little cost of the whole of the cyanogen in a form which is very valuable. Apart from these, there is something to be said as to the great indirect advantages which it affords to gas-works. One of the indirect advantages of this process of extraction by means of a liquid is that it materially assists the purifiers in the removal of sulphuretted hydrogen. This is due to the fact that, previously, the iron in the purifying material (oxide) was of use quite as much for the production of blue, while now, as cyanogen is no longer present in the gas which enters the purifiers, the iron is entirely available for the retention of sulphuretted hydrogen from the gas. It has been proved at various gas-works that the purifiers have been considerably relieved after this process has been introduced on the works.

It has already been stated that cyanogen possesses the property of decomposing freshly formed sulphide of iron, and thereby liberating sulphuretted hydrogen. This chemical property of cyanogen clearly is singularly inconsistent with gas purification as hitherto conducted; as it obstructs the absorption of sulphuretted hydrogen by the purifying material. The spent oxide can be readily reduced to a solid substance containing 60 per cent. of sulphur. Though free from blue, this spent oxide is not worthless, as it can be profitably disposed of for the manufacture of sulphuric acid.

Another advantage of the process worth consideration is that the gas which passes into the distributing system will now be completely deprived of cyanogen. From the hygienic standpoint, this result must be regarded as particularly beneficial. Illuminating gas which has not been subjected to any process for the extraction of cyanogen contains as much as 1 oz. of hydrocyanic (prussic) acid per 1000 cubic feet. On the other hand, gas from which the cyanogen has been abstracted does not injure the drums of wet meters, nor the sheets of gasholders, as is frequently the case, as the blue stains which are readily found on the plates indicate. Further, water or liquor removed from gasholders loses in great measure its poisonous qualities, which are due to the cyanogen dissolved.

The working figures of the German Continental Gas Company, and of other gas-works which have already adopted the process, show that it may be truly stated that the process offers gas-works a practical means for improving the purification of gas, and for obtaining simultaneously a bye-product which is valuable and readily disposed of.

THE ABSORPTION OF HYDROCYANIC ACID FROM ILLUMINATING GAS.

A Contribution on the Subject of the Progress which has been made in Gas Manufacture in respect of the Production of Yellow Prussiate (Ferrocyanide) of Potash by the Wet Process.

By Dr. A. Smits, of Amsterdam.

[A Paper communicated to the International Gas Congress at Paris]

The methods which have been used, up to a quite recent date, for absorbing the hydrocyanic acid of illuminating gas by means of liquids, have generally embodied the bringing of the gas, after it has been freed from ammonia, into contact with a solution of carbonate of potash holding a salt of iron in suspension.

It is strange that the absence of ammonia has been generally considered an indispensable condition for the satisfactory absorption of the hydrocyanic acid. The following phenomenon is probably responsible for this error.

When the gas which is brought into contact with the absorbing liquid contains ammonia, analysis discloses very little yellow prussiate of potash in the clarified liquor. But if the black precipitate, which is always formed during the absorption, is also analyzed, it can readily be shown that it contains an amount of cyanogen in proportion to the amount of ammonia which the gas contained. Therefore the total amount of hydrocyanic acid absorbed in this case is actually very large. In this manner a quantity of hydrocyanic acid is secured which would be lost during the absorption of ammonia in the ordinary scrubbing plant.

How can the fact that the presence of ammonia facilitates the absorption of hydrocyanic acid be explained? Modern physical chemistry teaches us that reversible chemical changes pure and simple, whenever they appear, can never be made use of to give a quantitative absorption. When gas which, in addition to hydrocyanic acid, contains two other acids—carbonic acid and sulphuretted hydrogen—is passed through the above mentioned absorbing liquid, various reversible reactions take place; so that no quantitative combination is possible unless the quantity of absorbing liquid is infinite. If, however, ammonia is present in quantity sufficient to neutralize the three acids, reversible reactions no longer occur. The reactions then take place quantitatively.

It should be added that the presence of ammonia favours the formation of an insoluble cyanide; because, as has been already stated, less yellow prussiate of potash is found in the liquid when ammonia is present. Such are the reasons which induced the author to think that the place for the absorption of the hydrocyanic acid had been wrongly selected. It seemed to him reasonable to attempt to absorb the hydrocyanic acid while the gas still contained an abundance of ammonia.

Under such conditions it is unnecessary to add a potash salt; as, in the presence of sufficient ammonia, all the hydrocyanic acid is retained in an insoluble compound of cyanogen. In place of carbonate of iron, a solution of ferrous sulphate may be used, with the advantage that it absorbs chemically a considerable portion of the ammonia.

Experience has proved that a concentrated solution of ferrous sulphate completely absorbs hydrocyanic acid, when the gas which passes through it contains plenty of ammonia. For instance, the gas as it leaves the Pelouze tar-extractor is well adapted for the purpose. The author had scarcely arrived at this conclusion, when he read in the "Journal für Gasbeleuchtung" that Dr. Bueb, of Dessau, had attained the same result from practical considerations, and that the new process had already been successfully applied at the Dessau Gas-Works. The results obtained at the Amsterdam Gas-Works confirm the facts assumed above. It has been there demonstrated that all the hydrocyanic acid can be absorbed in this fashion.

Notwithstanding its success, the method does not, however, completely satisfy the author. On the one hand, it is an advantage to fix the ammonia in the apparatus in which the cyanides are being recovered; but, on the other hand, this method has disadvantages with respect to the ultimate treatment of the absorbing liquid—at least if the gas-works is one where it is the custom to manufacture on the spot yellow prussiate of potash and sulphate of ammonia. In such a case, the author has found it preferable to substitute carbonate or hydroxide of iron for the ferrous sulphate; and experience on a large scale has completely confirmed his view. In order, however, to assist the ultimate treatment, not only is it desirable to use an insoluble compound of iron, but carbonate of potash should also be added. This is, however, a point of minor importance. The main question is that an absorbing liquid, made of water or a solution of carbonate of potash, to which has been added carbonate or hydroxide of iron, is preferable to a solution of ferrous sulphate if the yellow prussiate of potash is actually made on the gas-works.

The advances which have taken place in this branch of gas manufacture are therefore as follows: In the dry way, not more than 50 per cent. of the hydrocyanic acid could be absorbed; but in the wet way, as much as 80 per cent. Now, however, we are able easily and well to absorb the whole.

CARBURETTED WATER GAS AND ITS USE IN COAL-GAS WORKS.

By Henri Sospicio, of Trieste.

[A Paper read before the International Gas Congress at Paris.]

In a paper read by Dr. William Siemens before the Glasgow Science Lecture Association, in 1881, on "Gas and Electricity as Heating Agents," the immediate widespread use of gaseous combustibles was predicted. According to Dr. Siemens, towns would be supplied with two distinct gas services—one for lighting, the other for heating. The first would be produced in the earlier period of the distillation of coal, and the second in the later. If we may now regard this prediction as fulfilled in the case of illuminating gas, the practical methods by which it has been done are not those anticipated. The distinction between heating gas and lighting gas has broken down to a great extent; and the present tide of favour sets in the direction of the production of one gas, possessing a certain calorific power, which can be carburetted direct or can be used without carburetting during a part of the day.

Under present-day conditions—increased production and the higher prices of raw material—economy in manufacture is of the greatest importance to the gas maker, who must devote all his efforts to obtaining the greatest yield from every kilo. of coal. A conversion of 16 per cent. of the carbon in coal is not enough; nor is the transfer of 20 per cent. of the calorific power of the coal to the gas, when a yield of 60 per cent. of carbon and 85 per cent. of calorific power are possible by the use of water gas in conjunction with coal gas.

Water gas was invented in Italy, about the same time as coal gas. Its inventor was Félix Fontana, a celebrated physician, who was born in the Roveredo district on April 15, 1730, and died at Florence, Jan. 11, 1805. In the course of an experiment, Fontana observed that, when passing a jet of steam over a column of coke heated to incandescence, the latter gave off an

inflammable gas. Afterwards, the experiments of Cavendish showed that this gas was a mixture of hydrogen and carbon monoxide, and it afterwards received the name, "Water Gas."

It is surprising that the gas was not manufactured before coal gas, which requires a more complicated plant; but for a long time a practical and economical method of heating the carbon was unknown. This was discovered in 1837 by Faber Dufaur, was perfected by Frederick and William Siemens about 1860, and consisted in the making first of producer gas—that is carbon monoxide and nitrogen.

The methods of water-gas manufacture can be classed in two sections. In the first, the coke is placed in a retort, which is externally heated to incandescence. Steam is then admitted, and water gas produced. But this system is quite obsolete. Its low efficiency—due to the non-conducting properties of the containing vessel—was the cause. In the second system, there are two distinct stages. The coke is first heated to incandescence in a blast of air, and, when hot enough, the air-blast is replaced by steam.

Theoretically, water gas consists of 50 per cent. of hydrogen and 50 per cent. of carbon monoxide. The large proportion of hydrogen produces a high calorific value; but the carbon monoxide is, of course, the cause of the poisonous properties of the gas. The composition also shows that the gas has no lighting properties, and that none can be developed by any alterations of pressure or temperature. In practice, however, the ideal composition above given is never reached.

The decomposition of water vapour in contact with incandescent carbon proceeds theoretically according to the following equation:—

$$C + H_2O = CO + H_2$$

That is, 12 kilos. of carbon and 18 kilos. of steam ought to produce 30 kilos. of water gas; but during the passage of the steam over the incandescent coke, the temperature falls, and the reaction alters.

The researches of Harris, under the surveyance of Dr. Bunte, on the decomposition of water vapour by carbon at various temperatures, have shown that, as the temperature falls, the gas produced is less rich in carbon monoxide, and contains more carbon dioxide (CO_2). Harris's results are as follows:—

Temperature, Degrees Cent.	Composition of Gas. Volumes per Cent.			Water Vapour. per Cent.	
	H.	CO.	CO_2	Decomposed.	Undecomposed.
674	65.2	4·9	29·8	8·8	91·2
758	65·2	7·8	27·0	25·3	74·7
838	64·4	13·1	24·5	34·7	65·3
838	61 9	15·1	22·9	41·0	59·0
861	59·9	18·1	21 9	48·2	51 8
954	53·3	39·3	6·8	70·2	27·2
1010	48 8	49·7	1·5	94·0	6·0
1060	50·7	48·0	1·3	93·0	7·0
1127	50·9	48·5	·6	99·4	·6

These results show that, at about 600° to 700° the reaction follows the equation—

$$C + 2\,H_2O = CO_2 + 2H_2$$

and that only at 1000° and upwards does the theoretical decomposition take place—

$$C + H_2O = CO + H_2$$

If the generator could be kept at 1000° C., this would go on regularly; but towards the end of the period during which the steam is injected, the temperature falls, and the decomposition commences to follow the first equation. A secondary reaction arises from the sulphur in the coke, which forms sulphuretted hydrogen with the hydrogen in the gas.

The average composition of the commercial gas is—

		Per Cent.
Hydrogen	H ..	46·60
Carbon monoxide	CO ..	45 60
Nitrogen	N ..	4·30
Carbonic acid	CO_2 ..	2·30
Sulphuretted hydrogen . . .	H_2S ..	1·20
		100·00

The necessity of a very high temperature of the coke, and the difficulty of obtaining it by external heating, have led to the adoption of the plan whereby part of the carbon is burnt to obtain the required temperature. The familiar reaction then takes place in the generator; the oxygen in the air being just converted into carbon dioxide which, in contact with the excess of incandescent coke, is converted into carbon monoxide (CO). The change is the same as that taking place in the Siemens gas producer.

The producer gas of this initial stage is used, in some types of apparatus, for gasifying the carburetting materials of the water gas; in others, for maintaining the water-gas generator at high temperatures; and in others, again, it is led away and used for quite separate purposes.

Many different pieces of apparatus are used for water-gas manufacture—so many, indeed, that they cannot be here detailed. Those who wish to study them should consult Geitel's "Das Wassergas." The author confines himself here to certain appliances in general use, or those capable of more extended application.

In one type of plant, the coke is separately heated; in another the carbon is raised to incandescence by the combustion of a part of its own mass. Plants of the first type are obsolete; those of the second can be sub-classed into (1) those which produce only water gas which is used as such or separately carburetted, and (2) those which yield directly a carburetted water gas. Among those of the first class which are at present in general use, are the plants of Strache and Dellwik-Fleischer.

The Strache generator can be used with any kind of raw carbonaceous material—coal, lignite, coke, or anthracite. Starting from experimental results which showed that the proper working of the generator calls for a fuel containing as little volatile matter as possible, Strache designed an apparatus in which the gas coal or lignite was converted into coke before its use for generating water gas, by means of intensely superheated steam, and in part also by the combustion of a small portion of the water gas itself.

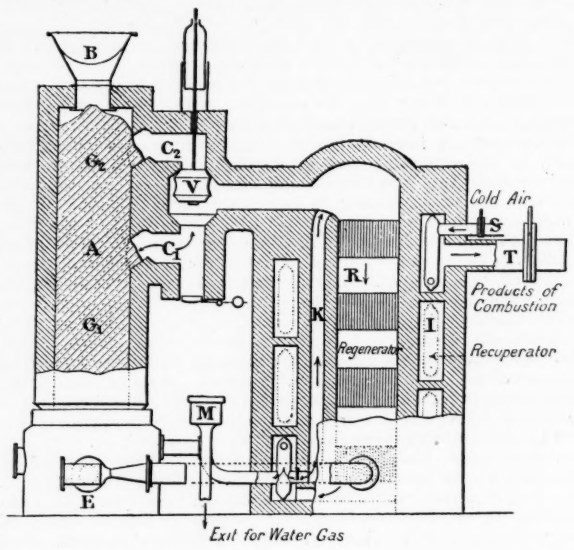


FIG. 1.

The apparatus (see fig. 1) consists of a generator A, fed with fuel from a shoot B, provided with a hermetically closing cover, a regenerator R, and a recuperator I. The fuel in the generator having been brought to incandescence, the current of air is drawn over the incandescent coke by an exhauster placed at the end of the tube in the recuperator I. The air, reaching the lower parts of the generator produces intense combustion, and is converted into carbon dioxide (CO_2), which, rising through the incandescent carbon in the upper part, is reduced to carbon monoxide. This is, of course, the producer gas. The valve V, being in the highest position, the producer gas passes by the pipe E into the regenerator, where it enters into combustion with air admitted by the pipe K; and the products of combustion, being compelled to pass through the recuperator R before escaping, give up a great part of their heat.

As soon as the necessary temperature is reached in all parts of the apparatus, the air is shut off, the generator fully charged with coal, the valve V closed, the valves ST closed, and the steam injector E set in action, after the valve M has been so adjusted as to allow full passage for the gas which is gradually formed.

The injector E draws in a part of the gas produced in the generator, and impels it (along with the steam) across the recuperator R, where it gets highly heated before reaching C_2. When it gets to this point, it is forced to pass over the fuel in G_2, which it first heats and afterwards distils. The products of distillation and the steam pass together through the layer of fuel G, where the steam is converted into water gas, and the distillate from the coal is decomposed. The gas thus produced passes from the generator, by the valve M, to be purified and for storage in the gasholder.

During the passage of the steam, the temperatures of the recuperator and generator have fallen, and the first operation of the process is therefore repeated. The required temperature having been once more reached, the production of water gas is again proceeded with, and so on.

Any Siemens gas produced in the generator in excess of that required for the heating of the recuperator is collected at T for other purposes.

With small plants, Strache places the yield of Siemens gas per kilo. of fuel at 4 cubic metres. A small proportion is used for vaporizing the water; so that a surplus remains for other purposes. The Siemens gas leaves the apparatus at about 1000° C.; and reckoning its calorific power at about 900 calories per cubic metre, one may place the heat available for other uses at about 4000 calories per cubic metre of water gas made.

According to Strache, the coke required in his apparatus per cubic metre of water gas is given in the following table, which applies to the use of superheated steam :—

Temperature of Air in Degrees Centigrade.	Temperature of Steam in Degrees Centigrade.										
	0	100	200	300	400	500	600	800	1000	1200	1500
1	2·06	2·03	1·99	1·94	1·89	1·84	1·78	1·66	1·49	1·32	1·01
100	1·76	1·73	1·69	1·66	1·62	1·58	1·53	1·42	1·29	1·14	·89
200	1·53	1·51	1·48	1·45	1·41	1·39	1·33	1·25	1·14	1·01	·80
300	1·37	1·36	1·33	1·31	1·27	1·24	1·20	1·13	1·03	·92	·73
400	1·25	1·23	1·21	1·19	1·16	1·13	1·10	1·03	·94	·85	·68
500	1·15	1·13	1·11	1·09	1·07	1·04	1·01	·96	·88	·79	·64
600	1·07	1·05	1·04	1·02	·99	·97	·95	·89	·82	·74	·61
1,000	·86	·85	·84	·82	·80	·79	·77	·73	·68	·62	·53

In small plants, the consumption of gas coke per cubic metre of gas produced is from 0·8 to 1 kilo.; while with large apparatus Strache hopes to reduce the amount to 0·5 kilo. per metre.

The average composition of Strache gas is as follows:—

	Per Cent.
Hydrogen	50
Carbon monoxide	40
Carbon dioxide	4
Nitrogen	5
Hydrogen sulphide	0·40

Oxygen, marsh gas, and iron carbonyl are present as traces.

Hydrogen sulphide is removed from the gas by the usual method of purification with iron oxides, while the iron carbonyl (which would be fatal to Welsbach mantles if left in the gas) is removed by sulphuric acid or by passing the gas through rough iron tubes.

Strache is a strong supporter of the sole use of uncarburetted water gas for lighting either with Welsbach mantles or with Fahnehjelm combs. Welsbach mantles have been used with it for the lighting of the principal hospital in Vienna.

In case of escape, water gas in the pure state is a serious danger—containing, as it does, 40 per cent. of carbonic oxide. It is, therefore, recommended that the gas be given a penetrating odour by the separate introduction of some substance such as mercaptan, or more economically, according to Strache, with the carbilamine of Dr. Jahoda.

The cost of water gas by Strache's process varies with the circumstances of individual cases. Some may have use for the producer gas formed at the same time; others, not. Strache, in his "Das Wassergas," gives data on the cost of installations and working, which have not up to now, however, obtained much currency as standard facts, but which may nevertheless be consulted by those studying the question.

In the Dellwik-Fleischer apparatus water gas is made, but no producer gas. Dellwik, from a consideration of the heat freed by the combustion of a gramme-molecule of carbon to carbonic acid (28,800 calories) and that of a gramme-molecule of carbon into carbon dioxide (viz., 96,000) has endeavoured to avoid the production of carbon monoxide by reducing the depth of the producer, and by regulating the air pressure so as to obtain as complete a transformation as possible of the carbon into carbon dioxide. He thus retains in the producer a much larger proportion of the heat available for the oxidation of the carbon, and so is able to employ the steam-blast for a longer time with consequent increased production of water gas per kilo. of coke

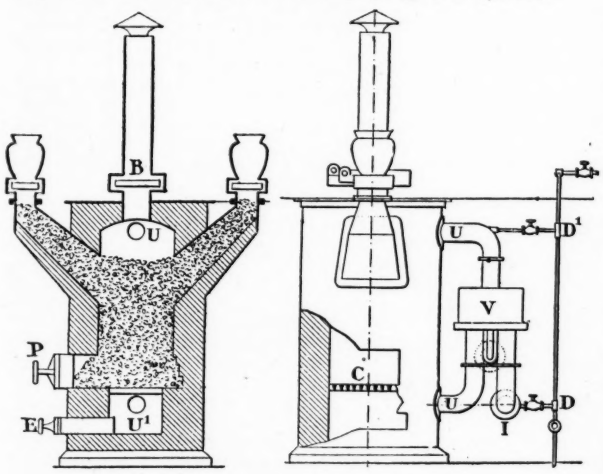


FIG. 2.

The Dellwik-Fleischer producer (fig. 2) consists of an iron generator lined inside with refractory material, and provided with two hoppers for charging, so that the apparatus can be fed alternately from either side. The height of the fuel in the generator is thus kept constant. This is in order to avoid any alteration in the speed of the current of gas. The generator is fitted with a valve B, connecting with the flue for the waste gases; with a furnace C; with two doors P and E, for the removal of clinker and ashes; with two outlets O O, and the valve V for the escape of the water gas; with two steam pipes D D; and with a pipe (provided with a valve) for the necessary air supply.

The action of the apparatus is as follows: The charge of fuel having been brought to incandescence in the usual way, the injector is turned on at D, and the water gas produced is led off at O. As the temperature is slightly lower in the bottom part of the producer, the injection of the steam is changed by allowing it to enter by the tube D; the gas passing to O. It afterwards finds its way to the purifiers by the pipe J.

These two periods having been concluded, steam is shut off, and the valve V is closed. The valve B is then opened, and the air admitted to the generator. The time during which the air-valve is open is from 1 to 1¼ minutes; that of gas-making, 8 to 10 minutes.

The average composition of the gas produced is as follows:—

			Per Cent.
Carbon dioxide	CO_2	..	4·65
Heavy hydrocarbons	C_2H_{2n}	..	0·05
Oxygen	O	..	0·20
Carbon monoxide	CO	..	39·65
Marsh gas	CH_4	..	0·82
Hydrogen	H	..	50·80
Nitrogen	N	..	3·83

With the Dellwik-Fleischer apparatus each kilo. of coke will give 2·48 cubic metres of gas, as is done at Königsberg. The gas produced can be carburetted after purification, either with benzol or naphtha.

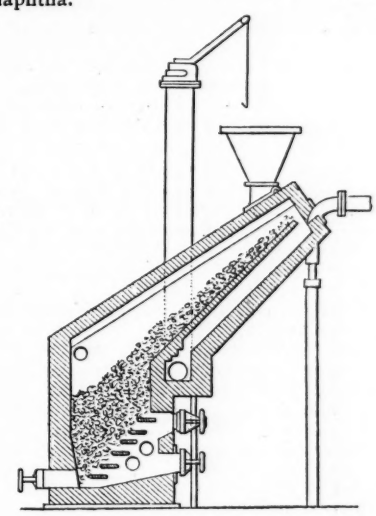


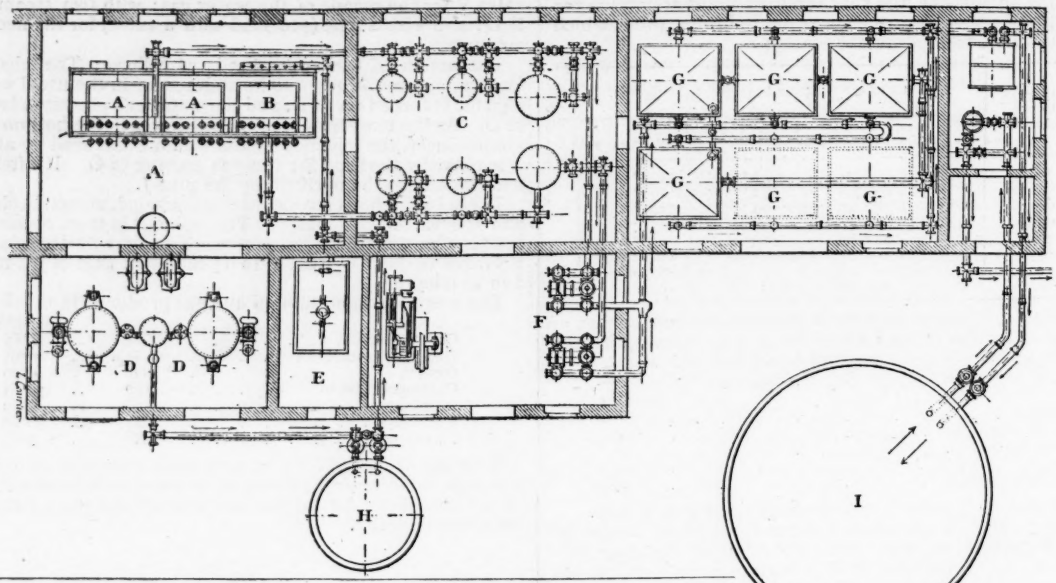
FIG. 3.

Dellwik has also studied a producer for making water gas, in which fuels containing volatile matters can be used, such as gas coal or lignite. The apparatus is shown in fig. 3. From this it will be seen that the gas produced is forced to pass under the "hearth" on which the coal is spread for distillation—an arrangement devised to prevent caking fuels attaching themselves to the sides of the producer. But having been once converted into coke, the fuel slides gradually down to the bottom of the generator, and is converted into water gas as already described. Very little, however, can be said at present as to the practical working or efficiency of these producers.

The special features of the Dellwik system have led to its extensive use during the past year or two—especially in Germany—in many ways. It is used particularly for producing water gas carburetted with benzol for the enrichment of coal gas.

The water gas produced in the Strache and Dellwik generators, although possessing a high calorific power, has no luminosity, in consequence of the absence of hydrocarbons. This fact makes it necessary to carburet the gas. Two methods of doing this are in vogue: (1) with benzol, (2) with petroleum or naphtha oils. Carburetting with benzol is a simple operation. The benzol is allowed to drop slowly through an apparatus on the Rau system. In the case of naphtha, on the other hand, it is necessary to first mix the water gas with oil gas of sufficiently high illuminating power, and to make a permanent mixture of the two. In order to obtain good results, it must be borne in mind that the carburetting plant ought to pass, in a given time, equal volumes of gas to be carburetted and of the carburetter, and that the temperature of the carburetting plant ought to be as nearly constant as possible.

The apparatus used by Dellwik for carburetting water gas with oil is on the Meyer system, and consists of a setting of four cast-iron retorts arranged in two tiers, one above the other. Those in the lower row are connected with the upper retorts by a chamber at the back of the furnace. The water gas enters the lower part of the retort, through a special valve; and on the same side the oil to be volatilized is injected. At the temperature of about 700° C. (which the retort should have), the oil is volatilized, and mixes with the water gas. The mixture passes through the upper retort, in which the high temperature permanently unites the two gases, giving a product which does not



A. Ordinary Retorts. B. Carburetting Retorts. C. Condensers and Scrubbers. D. Water-Gas Generators. E. Condensers. F. Exhausters. G. Purifiers. H. Compensating Gasholder. I. Storage Holder.

FIG. 4.

deposit oil at ordinary temperature and pressure. On leaving the retort, the gas goes to condensers; then to scrubbers and purifiers; and finally to the gasholder for distribution.

Fig. 4 shows the arrangement which may be added to an ordinary coal-gas plant in order to permit of the manufacture of Dellwik-Fleischer gas.

The quantity of naphtha oil which Dellwik states is required to carburet his water gas up to a lighting power of 16 candles is 0·268 kilo. per cubic metre. The fuel required in the furnace for the carburetting and the subsequent "fixation" of the mixture, is placed at 0·17 kilo. of coke per cubic metre of gas. The labour necessary for this operation is stated to be about 0·6 fr. per 100 cubic metres of gas; and the product contains 75 per cent. of gas and 25 per cent. of oil. According to Dellwik, 22 grammes of benzol are required per cubic metre to produce a 16-candle gas by carburetting water gas with benzol —using a mixture of 80 per cent. of coal gas and 20 per cent. of water gas. The cost of labour in this case is negligible.

Apparatus making carburetted water gas direct, without separately forming producer gas, is the kind which has hitherto been most used in England. The type of plant is that of Lowe, which has been variously modified in the Humphreys-Glasgow, Merrifield-Westcott, and Cutler installations. As shown in fig. 5, the Humphreys-Glasgow plant consists of three parts—the generator, the carburettor, and the superheater; the two latter filled with chequer brickwork. The coke in the generator being raised to incandescence, the making of producer gas commences. The producer gas passes to the carburettor, where it meets a current of air at a pressure of about 500 millimetres of water, by which the combustion of part of the producer gas is effected (a valve regulating how far this shall proceed). The products of combustion raise the carburetting apparatus to a high temperature; and along with the unburnt producer gas they pass to the superheater, at the entrance to which they meet with a further quantity of air, so that the complete combustion of the producer gas is thus brought about. They then escape by the flue.

The carburettor and superheater, having thus reached about 950° C., the second stage in the process commences. A jet of steam is turned on at the base of the generator; and this produces water gas according to the equation—

$$C + H_2O = CO + H_2$$

The water gas thus produced passes into the carburettor, so as to mix with a jet of oil (heated by the combustion of the gases in the previous stage). The oil is injected in the form of fine spray on an iron grating at the top of the carburettor. It volatilizes, and is thoroughly dispersed in the stream of gas by the chequer brickwork. The carburetted gas then passes to the

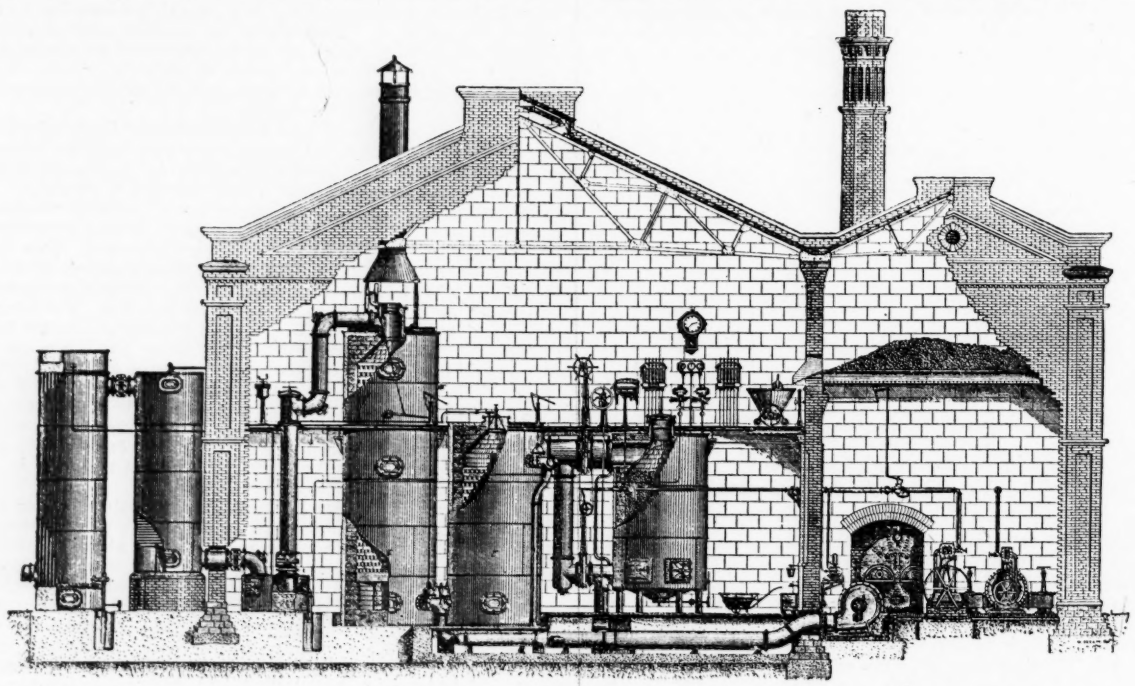


FIG. 5.

superheater, where the hydrocarbon vapours are permanently gasified. On emerging from the superheater, the gas goes through a hydraulic main (to prevent a return of gas from the gasholder) to a washer-scrubber, to a condenser, and lastly to a small gasholder, to which an exhauster is attached, whereby the gas is pumped to the purifiers or the works meter. As soon as the generator falls in temperature, air injection is recommenced. The first stage lasts from 3 to 4 minutes; the second, from 7 to 8 minutes.

It is easy to see that, by modifying the quantity of oil injected, the illuminating power of the gas can be altered in a few minutes —*e.g.*, from 0 to 30 candles—at will.

The Merrifield-Westcott-Pearson plant is on the same principle as that of Humphreys-Glasgow; it differs only in details of construction.

The mean composition of carburetted water gas, using solar distillate oil (a residue from petroleum distillation) of ·850 to ·950 specific gravity, is the following:—

Hydrogen	H	40·22
Marsh gas	CH_4	16·80
Heavy hydrocarbons	C_nH_{2n}	8·72
Carbon monoxide	CO	28·74
Carbon dioxide	CO_2	·00
Oxygen	O	·14
Nitrogen	N	5·38
		100·00

For the production of (say) 1000 cubic metres of water gas (16 candles) about 400 kilos. of oil are required; and, in order to further increase the lighting power by one candle, 40 kilos. of oil are required per 1000 cubic metres within the limits of 16 to 19 candles. The coke required per 1000 cubic metres is: For heating the boilers, 300 kilos.; for the generators, 700 kilos.

It should be noted, however, that the boilers can be fed with the tar from the water gas and with the residue from the generators—thus reducing the coke required. A cubic metre of gas can, therefore, be made with a little more than 750 grammes of coke.

Purification is a small matter. From 2·5 to 3 kilos. of oxide may be reckoned for purifying 1000 cubic metres of gas. Labour for a water-gas plant capable of making 35,000 cubic metres every 24 hours (exclusive of purifying) is from six to seven men per shift—including the engine and boiler men.

The space occupied by a works for this make—including purifiers but not gasholder—is about 500 square metres.

A few figures will show the superiority of water gas over that produced by the distillation of coal. Take, for example, a gas coal, such as—

Carbon	80·0 per cent.
Hydrogen	5·0 ,,
Oxygen	5·0 ,,
Nitrogen	1·5 ,,
Sulphur	1·5 ,,
Ash	3·0 ,,

Its calorific power will be found to work out to about 8000 calories. Distilled in the ordinary way, about 34 per cent. of volatile matter is obtained, which, after purification and condensation, gives 12 per cent. (by weight) of gas, 68 to 70 per cent. of coke, 5 per cent. of tar, and the rest ammoniacal liquor. The gas will have a heating value of about 12,500 calories per kilo.; and hence there will be scarcely $0{\cdot}12 \times 12{,}500 = 1500$ calories in the gas from 1 kilo. of coal, instead of the 8000 calories in the coal. About 5000 calories remain in the coke, and about 540 calories in the tar. But to obtain these 1500 calories in the gas, there must be used (in the best furnaces) 12 per cent. of the weight of the coal for fuel—*i.e.*, at least 840 calories. So that in the actual process there is obtained—

$$\frac{1500}{(8000 + 840) - (5000 + 540)} = 0{\cdot}45$$

i.e., a thermal yield of 45 per cent.

This loss is easily explained by the loss of heat through the thick non-conducting walls of the retorts, a fact which according to Lencauchez may give a thermal yield so low as 7 to 8 per cent. in badly constructed furnaces.

In water gas, there is no serious loss by radiation—no non-conducting walls. In the case of a Dellwik-Fleischer producer with 1 kilo. of coke of about 7000 calories, 2·48 cubic metres of water gas (yielding 2500 calories per cubic metre) are obtained. In this case the thermal yield is

$$\frac{2{\cdot}48 \times 2500}{7000} = 0{\cdot}88$$

i.e., 88 per cent.

The existence of so high a figure shows that water-gas generators are scarcely susceptible of further improvement in efficiency, and that the only direction for progress is in construction. No other machine gives so high a return of heat. Water-gas manufacture has, in fact, almost reached perfection.

The advantages of a water-gas plant in a coal-gas works are of two kinds—technical and moral. Rapidity of production, such that immense quantities of gas can be turned out in one-third or one-fourth of the time required by other systems, is one. To this, must be added the lower cost (less than half) of producing a given illuminating power by water gas compared with coal gas, and the small space required. Thus the plant can be expanded indefinitely. Then, too, water gas permits those who cannot sell their coke, or can command but a poor price, to cut down the production of coke to the point at which only enough is made to supply the water-gas plant. The huge mountains of coke too often seen, would thus disappear, and the gas maker would obtain interest on the value of the coke. The use, too, which can be made of water gas as an enricher of poor coal gas, enables cannel or boghead coal to be dispensed with; and the difficulties connected with the high price and poor coke resulting from these coals are thus removed. But perhaps the greatest advantage is in the economy of labour. In order to produce 35,000 cubic metres of gas per 24 hours, six to seven workmen per shift must be employed; while for the mere attention to the furnaces, the coke, and the coal, the same quantity of coal gas, even with inclined retorts or mechanical stokers, will require at least fifteen workmen per shift, and older systems will require considerably more.

The moral advantages are connected with the last-mentioned fact. The labour being small and simple, no skilled workmen are required; so that in case of labour trouble, any men of average intelligence could be at once employed on the work.

There is, of course, the poisonous action of the gas, which is much more powerful in this respect than coal gas. But this is a point that need not be exaggerated. Modern authorities on toxicology agree that there is no danger in its use under certain conditions. Professor Vivian B. Lewes, who was consulted by the Birkenhead Corporation on the disadvantages of water gas, was asked whether it was possible to sanction the distribution of mixed coal and water gases. He made many analyses of ordinary gas, of carburetted water gas, and of mixtures of the two, the results of which are subjoined:—

——	Ordinary Gas.	Carburetted Water Gas.	Mixture.
Hydrogen H	47·69	39·44	44·29
Marsh gas CH_4	35·75	16·99	28·95
Hydrocarbons C_nH_{2n}	4·88	8·23	6·74
Carbon monoxide CO	5·99	29·03	14·49
Carbon dioxide CO_2	—	—	—
Nitrogen N	4·76	6·20	4·46
Oxygen O	·95	·21	1·06
Lighting power in candles	22·3	22·7	21·3
Density (air = 1000)	549	647	—

From these results Professor Lewes concludes as follows: (1) There is no danger in supplying a town with a mixture of coal gas and carburetted water gas, so long as the percentage of carbon monoxide does not rise above 17. This figure means that (in the case of the gases examined) the proportions of water gas must not exceed 50 per cent. of the mixture. (2) Mixtures containing 50 per cent. or less of carburetted water gas are, under all ordinary conditions, similar in behaviour to coal and cannel gas; for lighting by incandescence and for heating they are much superior.

To this conclusion may be added that of M. Adolphe Wurtz, a Member of the Institut de France, who on June 12, 1878, wrote to Mr. C. G. Franklyn, the President of the Mutual Gas Company of New York: "There is no doubt that the danger of poisoning exists in the case of every gas containing carbon monoxide. Coal gas is not free from this defect; for it sometimes contains as much as 12 per cent. of carbonic oxide. But I believe that the danger, which may be serious in exceptional cases, is in general exaggerated, and need not be taken into account. You have made important progress in the ready production of the gas, and you have produced it with sufficient odour to make its presence known. Any attempt, therefore, to belittle the importance of your discovery seems to me to be reprehensible."

Many other favourable opinions might be cited; but it need only be mentioned that, even in England—where hygienic regulations are of the strictest—the opinion of a Commission of chemists and hygienic experts was taken, and they did not hesitate to allow a proportion of 20 per cent. of carbonic oxide in the gas. This means a larger proportion of water gas than 50 per cent.—a mixture which is not easily produced or exceeded in ordinary practice.

Import duties on carburetting materials have so far retarded the general use of carburetted water gas; but Governments will do well to consider this question. Much of the money passing to mining countries would be spent in districts poorer in fuel.

The general verdict will be that the use of water gas is likely to prove invaluable. Difficulties which now exist will be removed by future research. Thus the exhauster separator (of Mazza) of mixed gases, based on the separation of gases of different densities by centrifugal force, will be found to have an important application in water-gas technics, as it will enable the excess of carbonic oxide to be removed and used for heating retorts. It is possible, too, that chemical progress will enable the manufacturer to produce with his water gas the hydrocarbons necessary to render it luminous. Then the system will have reached a degree of perfection such as few industrial processes can show.

In summarizing the report of the discussion on the papers by MM. Sospicio and Dicke in last week's issue, it would (as we then stated) have been useless, in the absence of the text of the

first author's communication, to have given even an indication of the criticism passed upon it by Mr. A. G. Glasgow; and we therefore publish a report of his remarks this week. He said he had listened with so much pleasure to the descriptive portions of M. Sospicio's paper, that he sincerely regretted his inability to accept some of the most important figures presented by him. Were the discrepancies of ordinary character, the fine style and thought reflected in the paper would altogether restrain adverse comment on his part. The author entered into what was practically a comparison between two classes of gas-making apparatus —the one, producing blue water gas only; the other, producing carburetted water gas in the one operation. Two sources of error, to which all comparisons were subject, were observable in the present case: First, the conditions were not exactly similar; secondly, the figures themselves were erroneous. He would give the key to his argument by omitting all intermediate steps, and turn at once to the following equation in the paper—

$$\frac{2{\cdot}48 \times 2{\cdot}500}{7000} = 0{\cdot}88.$$

The Dellwik-Fleischer pamphlets claimed to have produced at Königsberg 2·48 cubic metres of gas per kilo. of carbon—not per kilo. of coke. Hence, in accordance with this claim, the efficiency of the generator would be about—

$$\frac{2{\cdot}48 \times 2500}{8100} = 76 \text{ per cent.},$$

instead of 88 per cent., as stated in the paper. This, be it noted, was for a simple producer making blue water gas only, which was but one step in the process of carburetted water-gas manufacture. In October, 1890, he (Mr. Glasgow) presented to the American Gaslight Association a completely detailed determination of the efficiency of a carburetted water-gas installation constructed in 1888—more than twelve years ago. This efficiency proved to be 81 per cent. in commercial operation. Each kilo. of carbon produced 2·65 cubic metres of carburetted water gas, or 1·75 cubic metres of blue water gas, *plus* the energy consumed in manufacturing 0·90 cubic metre of permanent oil gas. He might here point out that, when the candle power of the carburetted gas was reduced, thereby decreasing the energy required for the gasification of the oil, the yield of the blue gas should be correspondingly increased; and the art of manufacturing carburetted water gas lay in maintaining the efficiency, whatever were the relative proportions of the blue and oil gases. As the results he had indicated were not in accordance with those given in the present paper, it would be instructive to see where the principal discrepancies came in. The author stated that 400 kilos. of solar distillate oil were required for 1000 cubic metres of carburetted water gas of 16-candle power, and that a further 40 kilos. were required for each additional candle up to 19 candle power—making 520 kilos. of solar oil per 1000 cubic metres of 19-candle gas. This was equivalent to 5·16 candles per English gallon per 1000 cubic feet; and it was to be noted that the analyses showed the gas free from carbonic acid. Now it happened that the plants at both Rotterdam and Utrecht were tested by the respective Municipalitles when making gas of about this candle power. The average of their official tests, upon which the acceptance of the plants depended, was above 8 candles per English gallon per 1000 cubic feet—a result 55 per cent. higher than the figures in the paper. He had with him the working oil results of 22 representative installations; and the minimum was 40 per cent. better than the figure quoted by the author, and the average 47 per cent. Furthermore, the paper made no distinction between English and German standard candles; and all carburetted water-gas results hitherto published were expressed in English candles, having a value 20 per cent. greater than the German Hefner candle. With reference to fuel consumption, the paper gave 1030 kilos. of coke as necessary for the production of 1000 cubic metres of gas. This was equivalent to 62·3 lbs. per 1000 cubic feet. He had before him the returns from half-a-dozen installations where the gross coke for both generators and boilers averaged 37·8 lbs. per 1000 cubic feet; and, when a portion of the oil tar produced was burned under the boilers, this figure was reduced to 33·4 lbs. per 1000 cubic feet. The total figure given in the paper was therefore 65 per cent. greater than that frequently obtained in careful practice. Eliminating the boilers, he found that the figure quoted by the author for generator consumption alone was 54 per cent. greater than the average consumption at the twelve towns on the list he possessed. The remarks he had submitted regarding the paper by M. Sospicio seemed to be equally applicable to the *mémoire* of Herr Dicke. But he might add that a very complete discussion as to the relative merits of these processes had already taken place between Herr Dicke and Herr Gerdes, the Chief Engineer of the firm of Julius Pintsch, of Berlin.

Mr. J. Monkhouse has been appointed to act for the Corporation of Ossett in the arbitration in connection with the transfer of the undertaking of the Ossett Gas Company.

A rat-hole in the East Park reservoir at Philadelphia has been causing much trouble during the past few months. It was discovered by the appearance of a spring a little distance outside the embankment, which was traced to a burrow into which water passed through the brick and cement lining of the basin.

THE DELLWIK-FLEISCHER WATER-GAS SYSTEM.

By H. Dicke, of Frankfort-on-Main.

[A Paper read before the International Gas Congress at Paris.]

There is no need to inquire here into the history of water gas. The aim of the present communication is to describe the new Dellwik-Fleischer water-gas process, and to allude to the very considerable development which has taken place in this industry since its inception three years ago. The originator of the system is M. Carl Dellwik, an Engineer, of Stockholm; but it has been brought to its present stage of perfection largely through the scientific work of Dr. Fleischer.

The gas produced by this method is practically identical in its composition with that obtained by similar processes. The temperature resulting from its combustion is also the same; and, therefore, the efficiency of the gas for incandescent lighting is also the same, since the luminosity of the incandescent burner is solely dependent on the temperature of the flame.

The following analyses of gas from Dellwik-Fleischer generators are by Professor Vivian B. Lewes:—

Composition of Gas from Dellwik-Fleischer Plant.

	(1)	(2)	(3)
H.	52·43	50·09	52·76
CO	38·30	39·95	37·50
CO_2	4·73	5·38	4·08
O	0·74	1·22	0·46
N.	3·80	3·36	5·20

As these analyses show, the gas is not greatly different from that produced by other systems. The difference in the Dellwik-Fleischer plant lies in the efficiency of the apparatus.

The gas which issues from an ordinary gas-producer is, of course, carbon monoxide, which is burnt to carbon dioxide by a second supply of air. It is the heat produced by this reaction—carbon into carbon monoxide—which is applied to ordinary furnaces; and the combustion of one kilogramme of carbon produces a heat of 2473 calories. In the Dellwik-Fleischer plant, however, the gases emitted from the apparatus, in the first stage of the process, are carbonic acid and nitrogen—*i.e.*, each kilogramme of carbon produces 8080 calories. Therefore, the total heat thus available for the production of water gas is three times greater than in other processes, and hence a yield of 2 cubic metres of gas per kilo. of carbon is obtained—a figure which no other apparatus can equal.

According to the old theory of the combustion of carbon in a producer, carbonic acid gas was first formed, and was reduced to carbonic oxide by the incandescent carbon. But, as has been shown by scientific experimenters, what actually takes place is the formation first of carbonic oxide. It is known, moreover, that when there is no excess of air, only carbonic oxide is produced, as in ordinary water-gas plants worked with a deep charge of coke.

In the Dellwik process, the carbonic oxide first formed is converted into carbonic acid by an excess of oxygen; whence, as stated above, the total heat produced is three times that of any other method. This difference will be seen on comparing the figures of the two processes.

In the producer system:—

	Calories.
One molecule of water = 18 kilos. of steam to be decomposed = 2 × 28,780 =	57,560
One molecule of carbon = 12 kilos. converted into carbonic oxide =	28,800
Difference	28,760

Thus for the decomposition of 18 kilos. of water 28,760 calories must be supplied.

Let us now assume that, in the first case, the carbon produces carbonic oxide, and in the second carbonic acid; the theoretical quantity of air being used in each case.

		Calories.
A.—Old process—carbon into carbonic oxide: 12 × 2400 =		28,800
This includes the 16 parts of oxygen, which escape as carbonic oxide at about 700° C.; and hence remove (the specific heat of carbonic oxide being 0 248) 28 × 700 × 0·248 =	4,860	
We must also add 16 × 3·31 (= 52·9 kilos.) of nitrogen, which escapes at 700° C.; 52·9 × 700 × 0·244 (the specific heat of nitrogen being 0·244) =	9,035	
		13,895
Residual heat		14.905
B.—Dellwik process—carbon into carbonic acid: 12 × 8080 =		96,960
44 parts of carbonic acid remove at 1000° C., 44 × 1000 × 0·217 (the specific heat of carbonic acid being 0·217) =	9,548	
52·9 × 2 = 105·8 parts of nitrogen remove 105·8 × 1000 × 0·244 =	25,814	
		35,362
Residual heat		61,598

Thus, for the same consumption of carbon, the Dellwik process yields far more heat.

The high efficiency of the producers has been confirmed by such authorities as Professor Bunte, of Carlsruhe, Professor Vivian B. Lewes, of London, Dr. Lunge, of Zurich, Dr. Hempel, of Dresden, by managers of gas-works, such as Herr Schiming, of Charlottenburg, and others.

After the appearance of the process, competitors declared that they could guarantee a yield of 3 cubic metres of water gas per kilo. of carbon, whatever the fuel employed. But this is impossible, as the following figures prove: Water gas has a calorific power of 2600 calories; and hence the maximum yield possible from the combustion of a fuel of about 6800 to 7000 calories is $\frac{6900}{2600} = 2{\cdot}65$ cubic metres of gas per kilo. of fuel.

Dellwik gas carburetted has already received several applications in gas-works. It has been mixed with oil gas in such proportion as to yield a product of about the same illuminating power and density as ordinary coal gas. With supplementary water-gas plants it is easy to add carburetted water gas to coal gas up to 25 per cent., or more by arrangement with local authorities. The ideal conditions are to have as many retorts distilling coal as will yield enough coke for the production of the water gas.

The immediate result of working in this way would be a reduction in the coal distilled, and a consequent appreciable economy—an important consideration in view of the high and rising price of coal. In addition to this, it would become more possible to be independent of foreign coals and to use a less costly raw material.

On the Continent the system of Humphreys and Glasgow, as well as the Dellwik-Fleischer, occupies a prominent place. The former, which uses oil, cannot be economically worked in France or Germany, in consequence of the heavy duties on petroleum. The cost of 100 kilos. of Russian petroleum is 15·60 marks in Germany; and, in order to make 1 cubic metre of carburetted water gas of 16-candle power, 275 grammes of petroleum are required—*i.e.*, the cost of carburetting is 4·29 pf.

In the Dellwik system, 80 to 90 grammes of benzol are added per cubic metre of water gas. The price of benzol is only 18 to 20 marks; but, taking 25 marks as the outside price, the carburetting works out to 2·12 pf. per cubic metre—*i.e.*, 2·17 pf. cheaper. In France benzol may be taken at 24 marks (30 fr.), and petroleum at 32 marks (40 fr.); and on this basis the carburetting would cost:—

Humphreys and Glasgow	8·80 pf.
Dellwik-Fleischer	2·04
Difference	6·76 pf.

The following are methods of using the Dellwik gas for the enrichment of ordinary coal gas: (1) Separate storage of the water gas in a gasholder, and mixing this pure gas with coal gas before the whole goes to a large holder. The mixture to be carburetted with benzol at the entry to, or exit from, one of these large holders. (2) Separate storage of the purified water gas (carburetted with benzol) in a holder, and mixture of this gas with the coal gas before the whole passes to the principal holder. (3) The water gas may be stored in a holder, and led into the coal gas between the hydraulic main and the condensing plant.

The last method is particularly good in practice, for it is economical of benzol; the water gas taking a portion of the benzol from the tar during its passage through the condensers. The mixture of coal gas and water gas passes through the whole works' plant, and is brought up to the necessary lighting power by benzol before entering, or after leaving, the gasholders.

Königsberg was the first town in Germany to use Dellwik gas, which is carburetted with benzol. The gas-works of this town were in the position of having a gasholder capacity equal to only 30 per cent. of the daily make. This was in 1898; and the new works under consideration would not be finished before 1902. The Manager (Dr. Kinger) on the advice of Professor Blochmann, of the Königsberg University, put up a Dellwik-Fleischer plant, the success of which has exceeded the anticipations of those concerned; and the plant, which was erected for temporary use, is now a permanent part of the works. It has been noticed that, since the installation of water gas, naphthalene deposits have been much less frequent at Königsberg. The gas is carburetted by the second of the methods mentioned above. The mixture contains 20 to 25 per cent. of water gas; and the lighting power of the mixed gas in an argand burner of 32 holes is 18 Hefner standard units at 20 millimetres pressure. The calorific power of the mixture is about 5000 calories. No precipitate of iron oxide has appeared on incandescent mantles; while the results with gas-motors have been very favourable.

Many other German towns have installed similar plant; and the gas has found application, too, in the production of high temperatures—such as in steel-making in the Martin furnace, in the soldering of sheet iron, in making steel tubes, &c. An example of the industrial use of the gas is shown in Paris, in the Palace des Machines, among the exhibits of the Société Anonyme Fitzner et Gamper. Other firms are using the gas for glass smelting, for chemical operations, for driving motors, &c.

It will thus be seen that the Dellwik-Fleischer water-gas plant has rapidly found many industrial uses during its few years of existence.

THE HISTORY, CHARACTER, AND RESULTS OF THE EDUCATIONAL WORK CARRIED ON BY THE TRUSTEES OF THE GAS EDUCATIONAL FUND.

By Alfred E. Forstall, of New York.

[A Paper read before the International Gas Congress in Paris.]

The idea which finally resulted in the formation of the "Gas Educational Fund" originated in the mind of Mr. Walton Clark, and was brought to the attention of the American Gaslight Association in the presidential address delivered by him at the meeting of the Association held in 1895. In this address, Mr. Clark stated that the chief function of the Association was educational, and was carried out principally through the medium of the formal papers and discussions forming the greater part of the programme of the annual meetings. But, in addition to this education of the members themselves, there was a need of "giving systematic aid to the many boys and men who, without the advantage of advanced education, are struggling to fit themselves for positions of responsibility, while filling subordinate positions in our gas-works;" and in this direction the Association was doing nothing. He continued:

I respectfully submit that the Association is failing of its duty in this matter. There are no gas text-books. As far as I am aware, the only authority attempting the work of setting problems to tax the ingenuity of the gas student is the City and Guilds of London Institute. Its work, while admirable, is insufficient to meet the occasion. The field is broad; the work worthy the best effort of the Association. Its cost in money would be small. Its value to the industry, and to the youth engaged in it, may best be estimated by those of us who have worked our way up from the ditch or the bench without the advantage of a previously obtained education. I recommend to you a Standing Committee on Education.

This recommendation was adopted. A Committee was appointed; and the work was taken up by it under the active direction of Mr. Clark, who was made Chairman. The following extract from a circular issued in February, 1896, gives the outline of the method by which it proposed to accomplish the work committed to it:—

It is proposed to form a class of men and youths occupying subordinate positions in gas-works, or employed as superintendents of small gas-works, to whom shall be mailed, at intervals to be determined later, problems in gas manufacturing and distribution, and questions upon the sciences concerned with the manufacture and distribution of gas, together with suggestions as to the sources of information to be examined in studying the questions involved.

It is proposed to begin the work with but one grade of students—submitting problems and questions of the simplest character, and looking for the success attained to determine the future development of the plan.

The Committee hope that there will be enough of interest manifested to justify an extension of its work to the formation of classes of two grades, and the awarding of certificates of excellency at the termination of a two-years course in either grade.

It is not desired to include in the class now to be formed, students who have had the advantage of advanced or technical education, or of considerable experience in the gas business. The work is intended to "give systematic aid to the men and boys, who without the advantage of an advanced education are struggling to fit themselves for positions of responsibility while filling subordinate positions in gas-works." To stimulate their interest in the work, certain appropriate and valuable prizes will be awarded for the first, second, and third best answers to the examination questions, submitted at a time to be determined by the Committee. The prizes will consist of books, drawing implements, or chemical apparatus.

A class was started along these lines in March, 1896, with a membership of 76, which had been reduced to 44 by October through the failure on the part of the other 32 to answer the questions sent out. The experience gained by the Committee in the actual working of their plan led it to report to the Association, at its meeting in October, as follows:—

The work up to this point has been experimental and preparatory. From the 1st of December next the regular work of the class begins. It is proposed to send out four lists of questions a year, and to have these questions cover the entire range of the duties of the gas superintendent. The Committee believe that the good that can be obtained by a member of the class from work in the class is in but small part the privilege of receiving the answers to the questions. The greater good must come from the familiarity with the books, and from the mental training that he will get from working up his answers. With many of the class, the greatest good of all will probably be the clearing up of ideas that comes from their exact expression in writing.

The Committee referred in one of their circulars to the matter of prizes. After serious consideration, they have come to the conclusion that it will be better to expend whatever money may be at their command in such work as will benefit all of the class, rather than for the purchase of prizes which can benefit but few, and very possibly those who (all things considered) are less needful of assistance. Therefore, with your approval, the Committee will abandon the idea of giving prizes, and will expend such funds as may come into their possession for the purpose in circulating among the members such literature as they may be able to command and think will be of value to the class.

Between December, 1896, and January, 1898, the work of the Committee was carried on with regularity; the number of members of the class varying between 50 and 60. During this time, five sets of questions were sent out. Practically all the work of preparing the questions and the correct answers to them, receiving, examining, and commenting upon the answers of the students, and sending out the questions, answers, and comments

was done by Mr. Clark, who, though he was already a very busy man, was willing to give to the work the time and attention it required of him personally, even with the aid he received from his office force. But even he, though still intensely interested in advancing the welfare of the students and the Association, found himself unable to continue the work after January, 1898; and it was suspended pending the result of an effort to organize it upon another footing that was being made by a Committee of the Council of the Association.

The task set for itself by this Committee was to secure from gas companies, individual members of the Association, and other persons interested in, or connected with, the gas industry, subscriptions extending over a period of five years, and amounting to a sum sufficiently large to enable the payment of a salary that would compensate some competent person for devoting a large portion of his time to the work. The fund so raised was to be administered by a Board of Trustees, appointed in the first instance by the American Gaslight Association, but which after its appointment was to have the power of filling any vacancies that might occur in its membership. The President and the Junior Past-President of the Association were, however, to be *ex-officio* members of the Board. These Trustees were to have full power as to the selection of the person who should have charge of the work, and the handling of the money subscribed to the fund.

The labour of the Committee was successful. It was able to report to the Council, at its meeting in October, 1898, that it had secured subscriptions pledging the payment for five years of a sum amounting to $3193 per annum (this has since been increased to $4170 per annum), and that this showing warranted it in recommending the immediate appointment of a Board of Trustees of five members, three of whom were to be permanent and two *ex-officio* members, as specified above. The Council endorsed the recommendations of the Committee, and so reported to the Association, which thereupon gave the final confirmation to the suggestions by appointing the Trustees and committing the work to their hands. It also voted a sum of $250 per annum to be paid for five years from the general fund as its subscription to the Educational Fund.

The Trustees so appointed effected an organization in January, 1899, under the name "Trustees Gas Educational Fund;" and the educational work was resumed in February of the same year. This work is carried on by means of a correspondence class, membership in which is limited to those employees of gas companies who can secure the endorsement of their applications for admission by a member of the American Gaslight Association, or a subscriber to the fund. No tuition or any other fees are charged. The course of instruction has been made three years in length; the questions and problems set becoming more and more difficult from the beginning to the end of the course. A new section of the class is formed each year; each section being given practically the same course. The method of instruction is as follows.

On the 1st day of January, for instance, a set of twelve questions is sent out to all the members of a section; each section receiving a different set of questions. Answers to these questions, in the preparation of which the student is at liberty to use any and all means of securing information of which he can avail himself (and is encouraged to consult the Secretary upon any points which he does not understand or about which he can find no information), must be sent to the Secretary of the Trustees on or before March 1. The Secretary, who is in charge of the work, examines each set of answers carefully, and makes the necessary criticisms upon them in a personal letter to the student, which is mailed on April 1 together with what are considered by the Trustees to be the correct answers to the questions, and the next set of questions. Any general criticisms applying to the work of the section as a whole are embodied in circular letters. In this way four sets of questions are received and answered by the student each year; all the answers being commented upon by the Secretary.

All the students being, as stated, employees of gas companies, the work done in connection with the class must of necessity be done outside of working hours; and it is, therefore, impossible for them to answer a set of questions in a shorter time than two months. Owing to the number in the class, it is also impossible for the Secretary to give the proper attention to the answers in less than a month's time, which limits the number of sets to one each three months.

The questions deal with practical subjects and with those theoretical points a knowledge of which is necessary in order that the practical problems continually arising in gas-works may be fully understood and correctly solved. It is, of course, impossible to cover with 144 questions all the subjects upon which a gas engineer should be informed; but it is hoped that the effect of the three years' work will be to form in the case of each student a habit of study which, with the knowledge of where and how to find information already obtained, will lead, and at the same time enable him to continue by himself the work begun in the class. Special attention being paid to the exact expression by the student of the idea sought to be conveyed, the training in this direction must also be of great value. In fact, as is stated in the portion of the first report of the Committee on Education previously quoted, the mental training acquired will undoubtedly be of much greater value than the actual knowledge obtained from the answers to the questions, though it is hoped that these will form, in time, a valuable catechism for use by the student in gas engineering.

There being no inducement for membership in the shape of prizes, or the element of competition, and as membership cannot be maintained unless the student is willing to devote no small amount of his leisure time to the work, it is safe to assume that the great majority, if not all, of the members of the class possess an earnest desire to increase their knowledge of the business in which they are engaged. The fact that since its inception the number in the class has never fallen below 40, and that since the organization of the Trustees it has averaged 100, shows that this desire for increased knowledge is wide-spread among the employees of gas companies. The extent of this eagerness to learn, and the value placed by the students upon the means afforded to gratify it, as shown by the painstaking labour devoted to the work, has surprised even those with whom the idea at first originated. Instruction given by correspondence is necessarily more difficult to impart, and at best less complete, than instruction given by an instructor in personal contact with his pupils; but it is the only possible method of supplying the demand, when, as in this case, the hundred members of the class are scattered over an area of some 2,000,000 square miles.

It would also be better if the money at the disposal of the Trustees would permit the employment of more than one instructor, since more time could then be devoted to a study of the needs of each student, and the efficiency of the work be correspondingly increased. But even as it is, the work of the Trustees has proved of great value, as is shown by the record of the section of the class which completed its course on Jan. 1 last; and as this value is recognized, the size of the Educational Fund will increase, and still better results will be obtained.

I have so far dealt only with the advantages conferred by the class upon the students, and it may be thought by some that the gas companies which subscribe to the Educational Fund are philanthropically spending money for which no return is to be received. It is, however, hardly necessary at this day to enter into any elaborate argument to prove that anything that increases the efficiency of the workers in any industry must, of necessity, prove of immediate and great value to the industry itself; and that, therefore, anything that helps to increase the amount of knowledge of the art of gas making possessed by the foremen and superintendents of gas-works, and by the subordinates from whose ranks future foremen and superintendents must be drawn, cannot fail to return to gas companies increased profits many times greater than the small amounts required from each company to afford sufficient revenue to carry on the educational work in the most efficient manner. The more extended recognition of this truth will doubtless lead to a continual increase in the interest taken by the companies in the work of the Trustees, and to a corresponding increase in the amount of money at their disposal.

Although his knowledge of what is being done in other countries is necessarily incomplete, the writer is under the impression that the class carried on as described in this paper affords the only instance of an organized effort to help and direct students of gas manufacture in their endeavours to acquire the increased knowledge necessary for their advancement in their chosen profession without compelling them to leave their work and gather at some one place to receive the desired instruction. Such a course as that given at Carlsruhe or by the German Continental Gas Company at Dessau does not provide for the great majority of the employees of gas companies, who, though anxious to learn, must acquire their education as best they can in the leisure time at their disposal outside of working hours. It is the need of these men that the Trustees of the Gas Educational Fund are endeavouring to supply by the practical class, with a success that is already encouraging, but the true extent of which time alone can reveal. Is not the example worthy the study of all Associations of gas men with a view to its possible improvement and adoption?

TECHNICAL RECORD.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Dalkeith.

The Seventy-Ninth Half-Yearly Meeting of the Waverley Association of Gas Managers was held in the Cross Keys Hotel, Dalkeith, on Thursday last, and was well attended.

The Hon. Secretary (Mr. A. C. Young, of Kelso) said that, as they were all aware, their President (Mr. W. M'Giffen, late of Earlston) had gone to Huntly. He would be unable to be present; but he had sent his address, which would be read. Their first business was to appoint a Chairman for the meeting; and he moved that Mr. A. Bell, sen., of Dalkeith, be asked to take the chair.

Mr. Bell took the chair and returned thanks for the honour.

Next Year's Meetings.

On the motion of Mr. H. Rutherford (Aberlady), seconded by Mr. J. M'Laren (Duns), it was agreed that the meeting of the Association in April next should be held in Innerleithen, and the meeting in September in Musselburgh.

ADDRESS BY THE PRESIDENT.

The CHAIRMAN said that, in a way, it was unfortunate that their President was not with them; but, of course, they were all pleased that he had gone to occupy a better position. His address would be read by one of the Past Presidents.

The address, read by Mr. M'LAREN, was as follows:—

Owing to my removal to Huntly, I am sorry not to be able to personally perform the duties of President at the seventy-ninth half-yearly meeting of the Association. Though absent, I thank you sincerely for the honour you have conferred upon me by electing me President.

The subject of my address I will confine to the practical working of the retort-house, which I consider the most important factor in gas making. A good deal of worry and anxiety have been taken off the shoulders of the gas manager during these last few years by the introduction of regenerative settings. But there is still another important part to be considered, and that is the building-in of retorts—more so in small works, where practical retort-setters are not or cannot be employed, being more expensive than the local tradesmen. On this department depends a good deal of the profit-making; for one defective part will ruin the whole year's working. It is very annoying when one comes to light up a setting to find that the heats are not up to expectation; for if anything annoys a gas manager, it is dull heats and leaky retorts. Perhaps your retorts are a little twisted; the bed for same is made level, and as soon as the oven is lighted, the retort collapses, and then and not till then do we see the evil of our neglect. Of course, in works where experienced retort-setters are employed, that alters the case.

Another point I wish to state is the advantage of keeping the retorts clean—in other words, to allow as small a quantity of carbon to form on the retort as possible. Of course, this is rather a difficult matter. But it can be done to a great extent by keeping the mouthpiece clean, and allowing the retort to be well filled every charge, so that the rake or "hurll" may be caused to rub on the roof of the retort, which always tends to keep down any deposit that may arise. Another plan I have found to be very beneficial in profit-making is to slacken the lid of the retort about an inch or so after the charge is worked off, and allow it to remain so for fifteen or twenty minutes (as time will permit) before refilling. This allows a uniform heat to be raised all over the retort; and when refilled the charge is burned off much more quickly, which always helps the make of gas per ton of coal carbonized.

As regards the life of a retort, it is rather a difficult matter to explain, for some of them will last much longer than others. Of course, a good deal depends on the usage they get, and on the amount of heat they are required to stand. In my experience, I have used both English and Scottish retorts; and I have not found much difference in regard to quality. I think, therefore, it is best for every gas manager to test for himself, as some may prefer one, and some another.

In conclusion, there is one thing that must be borne in mind, and that is that cleanliness and tidiness ought to be maintained in the retort-house.

Discussion.

The CHAIRMAN said the President's paper was a short but a very practical one. Two or three points were raised in the paper, which were worthy of discussion. Retort-house work, for instance, and the keeping of the retorts clean, were matters which were within the knowledge of them all; and if they would all give their opinion with regard to them, it would be helpful. There was a feeling he had heard of that there was no need for the Waverley Association. He thought there was. Managers of small works had diffidence in expressing themselves in the presence of greater men. They were there a company of managers of small works; and that was, therefore, their opportunity for speaking their mind.

Mr. J. BLACK (North Berwick) said the President had taken a practical view of the matters he had dealt with. He believed that all managers of small gas-works had difficulties to contend with in the building of retorts. In country places these arose greatly from the want of practical skill on the part of those who set the retorts; and he thought it was the right thing that managers of small works should be able to guide a retort-setter, whether experienced or not.

Mr. W. B. M'LUSKY (Perth) thought the matters the President had brought forward were ones upon which he was thoroughly qualified to speak, because Mr. M'Giffen, in his work at Earlston, he believed, held the record in the district for economical retort-house work. He raised the make of gas to an abnormal extent, and reduced the price about 1s. 8d. per 1000 cubic feet—entirely due to economy in the retort-house. He himself had had experience of retorts built by handy men, by local masons, and by experienced retort-setters; and there was no question that the work of the skilled setter was the cheapest in the end. There was no doubt whatever as to the higher duty obtained from settings which were built by a man who knew his work; but there was no doubt, also, as Mr. Black had said, that the manager should be able to guide the retort-setter, so that the best results should be obtained. The regenerative setting was the best and cheapest, even for the smallest works. The initial cost would very soon be recouped. He was bound to speak in the highest praise of the results Mr. Young, who succeeded him at Kelso, had obtained in the retort-house. The results were certainly better than his were. He had never had any difficulty in keeping carbon off the retorts, even with the very highest heats; and he believed he had had the biggest make per ton possible. His difficulty was in controlling the illuminating power of the gas at the high temperatures. From 10,700 to 11,000 cubic feet per ton was a very ordinary yield from the kind of cannel that was used in the Border district; and managers there should never be content with a make of 9000 cubic feet. In the west country, where common coal or shale was used, 9000 cubic feet was perhaps a very satisfactory make; but that should be no standard for a Border manager, because he handled the best coal—whether he had a small works or a large, and whether he had an exhauster or not. In Selkirk, he had a rake made to do the work that Mr. M'Giffen spoke of; and the result was that very little carbon gathered in the retorts. What carbon there was could be removed in about ten minutes by using a gardener's squirt. In fact, with it no pinch was required. The leaving of the retort open for about fifteen minutes after the charge was drawn, he did not approve of; and he thought it was a method Mr. M'Giffen would not continue after he had tried another plan.

The HON. SECRETARY said he had to thank Mr. M'Lusky for his remarks with regard to his work in Kelso. In anything he had done there, he had simply been carrying on what Mr. M'Lusky began. The President spoke of cleanliness as being a great matter in the retort-house. Cleanliness meant that some system was carried on. Without system, it was impossible to keep a gas-works clean. They had chemistry in connection with gas manufacture; but they, as practical men, knew that it was in the working of the retort-house that the money was made. And systematic working went very far towards a successful financial record for the year. His experience had been in works where rich cannel coals were used. With high heats, there were large deposits of carbon, which were very difficult to remove unless the retorts had been, from the time they were lit up, thoroughly scraped daily. If the carbon were allowed to eat into the pores of the fire-clay, it was almost impossible to get it to disengage itself; but if the retort were thoroughly scraped, the carbon came away from it in scales. Those who had used a deep furnace with regenerative flues never thought of going back to anything else, and wondered why they had not adopted the system before. Anyone could have such an oven built; and he thought the results he himself had had with it were very much like those of Mr. Ewing, at Hamilton, as related by him in a paper read before the North British Association.* Mr. Ewing showed them that the existing arches were made to contain the retorts and the regenerative flues, and that he was able to get a yield of over 10,000 cubic feet of gas from ordinary Lanarkshire cannels. His own results were very much like that. He did not think it was necessary, in a small gas-works, to put in an expensive furnace. His furnace was all above ground. He had as much gas from it as he could consume with the air at his disposal. The regenerative flues were 6 in. by 9 in.

Mr. J. TULLOCH (Loanhead) said he had found it always best never to leave retort setting even to a practical man, but to look after him. Often a retort appeared from the outside to be well put in, but it might not be lying right, and so would soon give trouble. He considered it was the gas manager's fault if this happened, and not the mason's. The President spoke about filling the retorts and using a rake which would go back on the upper surface of the retort, and in this way clean the retort while they were drawing it. He did not see how this could be advantageous to the extraction of gas from the coal, because if a retort were filled to its utmost capacity, the make of gas would be deteriorated. As to the opening of the retort-lids and allowing the retort to heat up by the admission of air, certainly a little of that was very good; but if twenty minutes were allowed, he had always found that the little which was gained was lost by the cracks opening again.

The HON. SECRETARY said he remembered that in Perth, some fifteen years ago, with retorts charged with 1¾ cwt. of coal, the doors were struck, and the waste gases were allowed to blow off for twenty minutes every day. They had settings of threes; and under every three there were two furnaces. Even with two furnaces they never had heat enough; and the main reason for leaving the doors open was to raise the heat to incandescence for the new charge. If this were attempted now, with regenerative furnaces, they would simply melt the retorts, or bring them to such a state of heat as would vitiate the gas.

Mr. H. RUTHERFORD (Aberlady) very much doubted whether, let the retort be as full as they liked, the rake would clear the carbon from the top. He thought the opening of the doors of the retorts was a mistake, because he believed they would lose far more than they would gain by the opening up of cracks in the retorts, which would have to be filled up again before they could get the quantity of gas they wished. High heats were spoken of; but in regard to trouble with carbon, he thought there was a good deal in the dip of the pipe in the hydraulic main. Too deep a dip he had no doubt caused a great deal of the deposit of carbon in the retorts. He had tried everything—including scraping—but unfortunately he could not get quit of carbon. He had shortened his dips in the hydraulic main, and carbon still gathered. Mr. M'Lusky spoke of spraying with water. This was the first time he had heard of such a thing.

Mr. M'LUSKY said that he would like to emphasize the point.

* See "JOURNAL," Vol. LXXII., p. 306.

He hoped it would not be understood that he deluged the retorts with water. On the contrary, he had a nozzle on the squirt barely $\frac{1}{16}$ inch in diameter; and the water was put in with such velocity that it was really a very fine rain shower impinging on the carbon at the point where the tool was working. The stoker knocked off the carbon with a bar. It had always been his practice to give retorts every year three coats of enamel with a fire cement. The first coat was a priming, the second was a little thicker, and the final one was of the consistency of pretty thick paint. The result was that the interior of the retorts was really enamelled. He understood that the son of their Chairman had been getting glazed retorts at Innerleithen, and with very beneficial results. There was no doubt that this operated in somewhat the same way. Doubtless, if every retort were enamelled as he had spoken of, the carbon would come off with the water spray. He believed, with regard to firing, that where many went wrong was in the producer. Most of the furnaces had too big a furnace-bar area. The addition of too much air reduced the heat. He had always had the best results with deep fires, with the producer no hotter than the inside of the retort. This might be taken to be a very dull heat; but, in the chamber above, the temperature was kept at a sparkling heat. He was heating five retorts with one furnace; and he had lately reduced the furnace area to 150 square inches. Many, he presumed, had more than that for three retorts. He had gradually been coming down from an area of 250 inches, with great benefit and saving.

Mr. J. Gemmell (Melrose) said he found, in starting a new retort, that it was good to have it thoroughly well scraped, to keep down the deposit of carbon; and also that the putting of a little common salt into the coal enamelled the surface of the retort and prevented carbon adhering to it.

Mr. P. Blair (Haddington) believed that where there was no exhauster the slackening of the lids of the retorts once a week or so, for half-an-hour, would keep down the carbon. It must not be allowed, however, to go so far as to burn out the cracks. Where there was an exhauster, they might go longer without scraping.

Mr. F. W. Carlow (Lasswade) said he had tried scraping and the opening of the retorts, to get rid of carbon; but he found that it gathered in spite of all. He now let it grow a certain distance, and then inserted a pipe through the mouthpiece, and opened the ascension-pipe lid on the top. This took off the carbon; and, burning it in that way, he had run retorts for three years. By this method they did not open up the cracks; and no pinching was required. The pipe he used was a 2-inch boiler-tube; and he had never melted it. A strange thing happened to him last winter. He found his hydraulic main pitched pretty thickly. He continued to work it; and recently, when he dipped it, he found the pitch all removed, and a light tarry substance in its place. Of course, in the summer time the heats were reduced. As regarded retort-setting, he believed he employed one of the most experienced setters. He had three retorts in an oven. Let him do what he would, he found that the top retort cracked—a circular crack. It was the top retort which usually gave way first. Yet he watched the building in of them, and had the work done according to the best plan.

The Chairman explained that his retorts were built in about 12-inch sections; and the section built they were obliged to let dry to such a consistency as would carry the next section. He had had retorts which broke at each section of 12 inches. They could not blame the setter for that.

The Hon. Secretary said that the burning off of the carbon by means of a pipe was a very common experience in the West of Scotland, where they got tile pipes for about 6d. each. Of course, the pipes were useless when once employed.

Mr. M'Lusky said that, with regard to using a pipe in this way, the time-limit had always been a consideration with him.

Mr. J. M'Laren (Duns) remarked that when in Ireland, nine years ago, he was terribly troubled with carbon. On one occasion it was 2½ inches thick. He sprayed with water, and a man pokered it. It very soon came away. When he went to Duns, there was very heavy carbon in the retorts. They were then working with 11 inches of back-pressure. This had been reduced to 4 inches; and now, except at the very mouth of the retort, he never had more than 1 inch of carbon.

The Chairman thought it was wrong in principle to fill the retorts as spoken of. They would all have read Mr. Young's paper, which was printed for the last meeting of the North British Association,* and also Professor Lewes's really able lecture before the last meeting of the Institution of Gas Engineers.† These were diametrically opposed to the proposal here, because, in order to get the largest volume of gas of high quality, they must have a free space, to allow the radiant heat to act. If a retort were full up to the top, the gas which was made at the back or middle of it had to wind its way through the interstices of the coal. It was in continuous contact with the hot coal. This was not radiant heat, but contact heat; and the gas got broken up, and became crude hydrocarbons. He thought the idea suggested was exploded long ago. With regard to deposits of carbon, Mr. M'Lusky said that with an exhauster there should be almost none. He thought this was a mistake, because the more rapidly the gas came out of the retort, the less time it was exposed to the action, not only of the coal, but of the surface of the retort. If carbon did grow, his experience was that the better way was not to open the door to begin with. The moment they opened the door, the first particles of carbon—the heat being about 1200°—became carbonic acid. The iron mouthpiece expanded and broke the joint; and this was the way they had leaky mouthpieces. It was a bad practice to open the doors. The burning off of the carbon by means of a pipe was simply taking the oxygen of the atmosphere to the very back of the retort. The moment they did this, the carbon heated up very rapidly. Give it oxygen, and it became carbonic acid and burned away freely. Instead of filling up the retort, would it not be better to charge it in a normal way, and get a rake made with which to scrape the retort every charge. This would save a quarter of an hour's time, and there would be no risk. Instead, they would smooth the surface of the retort. Clay retorts were porous; and they knew that the more porous a retort was, the stronger it was, and there was also more carbon. With the slightest back-pressure, the gases began to find their way through a porous retort; and they burned on the outer surface. Therefore, a retort which was absolutely tight was very much more difficult to heat. He had used glazed retorts for two years. He believed it was his son who first of all asked why it was necessary that gas managers should require to glaze the inside of their retorts, and why the manufacturers did not glaze them while they were burning them. There was now no carbon to sell at the Dalkeith works. Formerly he had 4¼ tons of carbon to sell in a year. Last year, with glazed retorts, he had not 2 cwt. If any carbon formed on a retort, all that was required was to touch it, and it fell off and left the surface clean. He recommended glazed retorts to everybody. There was a retort on the market which gathered no carbon; but it was of so fine grain that it would not last a second season. It stood the heat once; but if let down and heated up again, it fell to pieces. As to the depth of dip in the hydraulic main, he thought it was the opinion of everybody that the least possible seal they had the better. With regard to Mr. Carlow's strange experience, it was simply the hydrocarbons taking up the pitch when the heats were reduced. If they wanted to make a good varnish, they had only to mix pitch with naphtha or other light oil. They could reduce pitch by this means; but, in doing it, they would lower their illuminating power.

Mr. H. O'Connor (Edinburgh) said his remarks would be somewhat opposed to those of the Chairman. In London, their idea had always been to put as high a charge as possible into a retort, in order to leave the smallest space between the top of the coal and the top of the retort, which was a very hot place, so that the gas as it was made was forced forward, and got away from the heat as quickly as it could. The quickest method to get it away was to leave a small space, so that it had to travel faster, and had not time to play against the heated surface of the retort, and so get burnt up what should be passed on with the gas. This, he believed, was the custom, down to the present time, in most of the works in the South. He had used a tube in retorts—a 1-inch wrought-iron tube 9 feet long—and he never had any trouble. He kept the tube in from 24 to 36 hours; and he got all the carbon removed. Possibly he employed it oftener than in other works, and did not require to use it so long. The question of the durability of the pipe, he thought, depended upon the height of the rising-pipe, according to whether they got a good or a bad draught. If they had a short ascension-pipe, they would not have the same amount of draught, and the quantity of air passing in would not be sufficient to keep the pipe cool. There was an arrangement for putting air into boiler-furnaces which acted in a somewhat similar manner. As regarded Mr. M'Lusky's remarks about the area between the furnace-bars, a method he adopted a good many years ago, with a simple regenerative setting he put up, was—it was an old-fashioned furnace door—to fit a bent iron plate so as to cover over the space where the ash-pan came, in front of the setting, with a bolt at each side of the furnace-frame; and when a stoker, after he had cleaned his ash up, pushed the plate back into its place, the bolts prevented it getting close up to the setting, and they could set it so as to get air sufficient to form carbon monoxide in the setting itself, and to form carbon dioxide where they got the secondary air in. In this way, he managed to overcome the difficulty about the space between the bars. He had seen a great many regenerative settings in small works; and he had come to the conclusion that many of them were really too elaborate—there was too much attention given to the provision of secondary air. He thought much smaller channels would be sufficient to get all the heat that was necessary. Before he left the Beckton works, he used nothing except bricks and tiles to make the regenerative portion of the setting; and they answered most admirably. In one case he had, in a furnace, three retorts 20 feet long; and one furnace did for them all. Of course, the furnaces were very deep; and it was one of the most important points to make the furnace sufficiently deep to have the secondary air, as it entered, formed into carbon monoxide, and, in passing up, formed into carbon dioxide. The only way to get this was by having a considerable depth of fuel in the furnace. This, of course, might be difficult in small works. If anyone was building new furnaces, he should make the arches sufficiently high to enable him to deal with the secondary air in this way. As far as the primary air was concerned, it did not require much heat; but it was well, if they could, to give one layer of the chamber

* See *ante*, p. 282. † See "Journal," Vol. LXXV., p. 1194.

to heat it up. As regarded mason work in the furnace, it was important that the joints should be made very small. A great many masons were not accustomed to fire-brick work and were not careful to keep their joints small enough. Then, a broken edge of a brick should never be laid where the fire had to play upon it. Wherever there was a broken edge of a brick, it at once started burning away. It began to alter its condition and to run much sooner than the surface of a brick which was whole. He thought this had a good deal to do with the breaking down of settings which looked to be thoroughly well laid.

VOTES OF THANKS.

The CHAIRMAN proposed, and the meeting agreed, to record their thanks to the President for his address.

Mr. M'LUSKY proposed a vote of thanks to the Chairman for presiding, which Mr. BELL acknowledged.

This concluded the meeting.

FESTIVITIES.

The members and friends dined together in the Cross Keys Hotel. Afterwards, through the kindness of the Lothian Coal Company, Limited, they enjoyed a drive through Eskbank, Bonnyrigg, and the policies of Dalhousie Castle, to the Company's "Lady Victoria" pit at Newcastle. They were there met by the General Manager of the Company (Mr. J. A. Hood), the Secretary (Mr. J. Callendar), and a number of officials, who extended a cordial welcome to the visitors, and proceeded to show them over the pit workings, which are the largest and most modern in Scotland. The pit is only a few years old. Its depth is 1656 feet. The winding engine is of 2400-horse power; and there are besides large pumping and ventilation engines. The shaft is employed to draw coal from the new and old workings over a wide area. The output at present is about 1000 tons per day; but it may be increased to 2000 tons. The far-famed Newbattle Cannel is worked from this pit. Mr. Hood explained that the journey to the cannel workings would be so long that it would take an hour-and-a-half to get there and back. It was therefore agreed to be content with viewing the getting of the ordinary splint coal. The visitors were shown the engines, the screening and the washing machinery at work; and those who wished to go down the pit were allowed to do so. Nearly everyone went. The cages, it may be mentioned, are capable of carrying 48 men at one journey. Refreshments were afterwards served in one of a new range of workshops.

The CHAIRMAN proposed a vote of thanks to the Lothian Coal Company for allowing the visit to be made to their works, and for the entertainment they had provided.

Mr. HOOD expressed the pleasure they had in making the personal acquaintance of so many of their customers. They were, he said, upon historic ground; for coal mining was begun there seven hundred years before, by the monks of Newbattle, and it had gone on ever since. He was very glad to find that cannel coal was not yet a thing of the past. He believed that, notwithstanding all that had been said about oil gas and the like, cannel would hold its own.

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting at San Francisco.

(*Concluded from p.* 646.)

Mr. O. M. Gregory, of San José (Cal.), the Editor of the "Experiences" Department, read his report. It commenced by detailing some practical working in connection with the use of a steam-jet exhauster for revivifying oxide *in situ;* and preference was expressed for revivifying at regular and short intervals, rather than letting the material run till a foul test was shown at the outlet of the purifier. A writer described a device for use when it was necessary to work in a poisonous atmosphere, which consisted simply of a 50-feet length of 1-inch hose and a speaking-tube mouthpiece. With the aid of this simple arrangement, he had remained in a pit in which a large quantity of gas was escaping from a broken main for 15 minutes, and could have stayed there for hours. One end of the pipe was left open to the air, the other, to which the mouthpiece was attached, was held over the mouth by one hand. He inhaled through the tube and exhaled from the nostrils.

The contents of the "Question-box" were next examined; and the first item related to the use of gaseous fuel for hot-water radiators. Mr. Britton said he had tried it for this purpose, but found it too expensive. He was, however, supplying gas to a firm for the purpose of generating steam under an ordinary upright tubular boiler; and the installation had proved an entire success. At the outlet from the boiler-flue, he had fixed a superheater constructed out of about 100 feet run of ordinary ¾-inch pipe; and in passing through this, the water was raised to 185° Fahr. by the waste gases before entering the boiler proper. Mr. Grimwood said that he had been afforded an opportunity of inspecting the arrangement just described, which consisted of an upright boiler about 6 feet high by 2½ feet diameter. The consumer was perfectly satisfied as regarded his gas bill; and the whole affair was a success. Another question led to a discussion on the respective merits of Welsh, Pennsylvania, Colorado, and New Mexico anthracite. The latter was considered very satisfactory, but there was a difficulty in getting regular supplies. The Welsh anthracite was said to leave a lot of waste from screenings; and the Colorado coal contained a great deal of sulphur and ash.

The meeting closed with the usual votes of thanks.

THE HEATING AND LIGHTING POWER OF COAL GAS.

By T. FAIRLEY, F.R.S.E., F.I.C., of Leeds.

[A Paper Read before the British Association at Bradford, Sept. 11, 1900.]

The consumption of coal gas for heating and gas-engine purposes is constantly increasing, and in populous districts varies from 20 to 50 per cent. of the amount manufactured. Legislation provides a candle unit for measuring the lighting power of gas; but no notice has been taken of variations in heating power. As to the relations of heating and lighting power, opinions differ. On one side, it is said that a high lighting power gas is no better than a lower gas for heating and engine purposes ("Encyclopædia Brittanica," Vol. X., p. 102); on the other, a definite relation has been traced between the two (Aguitton in "Compt. Rend.," Vol. CVII., p. 56-58; "Journal of the Society of Chemical Industry," 1894, p. 26).

To obtain the best lighting or heating effects, the apparatus must be adapted to the gas. By ignoring this, either as regards lighting or heating burners or gas-engines, misleading results may be obtained. From an economic point of view, each candle-unit costs so much; and it is a question of price whether the extra candle of 16 over 15 candle gas, or of 17 over 16, &c., is worth the additional cost of production. If the heating power marches with the lighting power, the same consideration applies to the heating value. From a health point of view, the less gas that can be made to supply the light required the better. The introduction of the incandescent and other improved burners shows how much we have still to learn in obtaining light by the combustion of coal gas. The luminosity of incandescent burners is largely an effect of high temperature, rather than of quantity of heat; and I shall not refer to it further in this paper.

Coal gas is a complex mixture, varying in composition with the coal distilled and the conditions of manufacture. Speaking broadly, it is a mixture of hydrogen and marsh gas, with smaller quantities of heavy hydrocarbons, oxides of carbon, aqueous vapour, nitrogen, &c. In ordinary burners, the lighting power depends chiefly on the heavy hydrocarbons. The heating value is also affected by these, but depends mainly on the marsh gas and hydrogen, which form 70 to 80 per cent. of the gas.

In gas made from common coal, with a lighting value of 12 to 17 candles, the heating and lighting values march well together. If any material proportion of air is drawn into the gas before it is consumed, or if the gas first given off from the coal is collected separately from that given off last, the relations of heating and lighting powers are materially affected. Air or nitrogen in gas lowers the lighting power more than the heating power; whereas heavy hydrocarbons have an opposite effect. This latter consideration applies to gas enriched with light petroleum ("carburine") or with benzol, and explains why carburetted water gas has a much lower heating value in proportion than coal gas. In my own and other experiments, its value is lower, by at least 10 per cent., than that of coal gas of the same lighting power. In gas made from the same kind of coal, the heating and lighting powers march together; and a calorimeter kept constantly working may be used to watch the gas, in place of a jet photometer. With mixed gases, it would not be applicable; in that case only a full photometric test would give the true lighting power.

Since gas has been so much used for heating, the measurement of its heating or calorimetric value assumes additional importance. Various calorimeters have been devised by Berthelot in France, Junkers in Germany, and Dowson in this country. The two latter are adapted for continuous working, and are very similar in principle and construction. In both, the products of combustion are made to pass through metallic syphons, so as to give up all their heat to a circulating current of water. Knowing the quantity of water heated during an experiment by so many degrees, the heat units are obtained; and reading the volume of gas consumed during the experiment, the heat units per cubic foot of gas are calculated. In these instruments, the steam produced by the combustion of the hydrogen in the gas is condensed into water. If it is desired to deduct the heat due to this condensation, the water is collected and measured. With such a large surface wet with the condensed water, this correction can only be an approximate one. The amount of water obtained from gas of from 15 to 18 candles averages about 25 c.c. per cubic foot of gas, corresponding to 15 calories, or about 60 British thermal units. The following average results have been obtained with coal gas:—

Lighting Power, English Standard Candles.	Heating Power, British Thermal Units. (Pounds of Water Heated 1° Fahr.*)
11	533
12	555
13	578
14	601
15	624
16	648
17	676
18	704

* Not corrected for steam condensed.

These numbers are comparable with those obtained by Aguitton, but are lower.

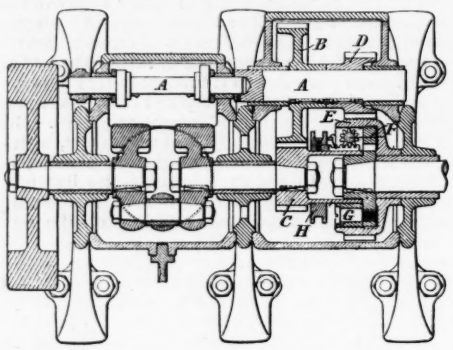
To obtain trustworthy results, the following precautions are useful: The calorimeter should be carefully shielded from all draughts. The gas should pass through an efficient governor; and the water supply should be as constant in pressure as possible, and should leave the calorimeter at a constant level—that of the top of the instrument. It is well to place a mirror under the burner, so that the flame may be seen at any moment. The flame should be clear and steady; and no result should be accepted with a flickering or unsteady flame. In starting the instrument, it is often some time before a steady flame can be obtained; and for this reason the instructions sent out with the calorimeter (to turn off the gas at the meter at the close of an experiment) would be much improved by directing the gas to be turned into a bye-pass past the meter, so that the working of the calorimeter for the next experiment should not be interfered with.

REGISTER OF PATENTS.

Variable-Speed Gearing for Gas-Engines.—Simpson, W. E., of Victoria Street, S.W. No. 12,136; June 10, 1899.

This invention relates to the arrangement of speed gearing shown for use in conjunction with motors working on the "Otto" or four-stroke cycle. It is self-contained with the motor, so as not to require separate foundations or framing.

The usual half-speed cam-shaft A, and a pair of gear-wheels B C, are made of such strength as to be capable of transmitting the whole power of the motor; and on the cam-shaft is mounted a third pinion or wheel D, gearing with a fourth pinion or wheel E co-axial with the motor-shaft. In line with the motor-shaft is a second shaft, upon which is a clutch adapted to engage either with the motor-shaft itself or with the fourth



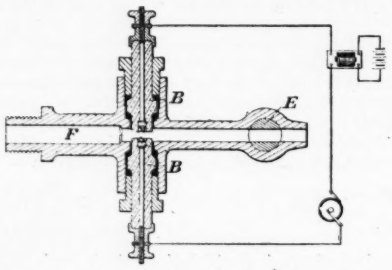
pinion or wheel E, in such manner that the second shaft may be driven at the same speed as the motor-shaft, or at such other speed as is determined by the ratio of the third and fourth wheels D E respectively. The ratio of the first and second gears must be two to one (or a multiple thereof)—as four to one, in which case the cams would be double, so as to give two four-stroke cycles per revolution of the cam-shaft.

The clutch preferably consists of a disc F keyed on the second shaft, a ring on the disc driven or carried by pins G (and split in one or more places), and a grooved collar H adapted to be moved laterally by a lever or other means upon a rim extension of the pinion C, and having racks secured to the collar so as to gear respectively with pinions in the adjoining ends of the segments of the split ring. Thus, when the grooved collar H is moved in one direction, the ring is expanded and forced against the annular extension of the fourth wheel E; while when it is moved in the other direction, the ring is contracted upon the rim extension A of the pinion C.

Igniters for Gas-Engines.—Simpson, W. E., of Victoria Street, S.W. No. 12,138; June 10, 1899.

This invention has for its object to render the sparking-points of gas-engine igniters capable of being readily inspected and cleaned.

According to one arrangement, an electrical igniter is formed (as shown) of a barrel or pipe in communication with the cylinder, and having two insulating plugs B (each carrying a sparking-point), preferably arranged diametrically opposite to each other, so that the sparks pass from one to the other across the barrel. The outer end of the barrel is closed by a



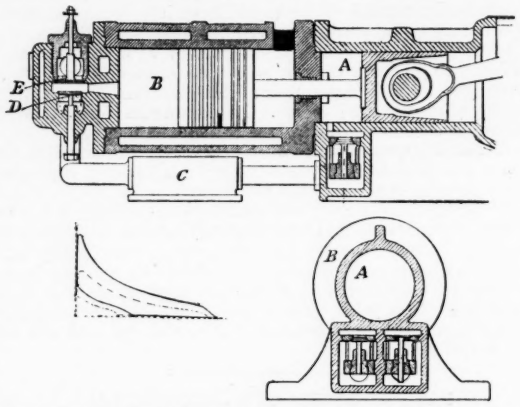
plug E (similar to a cock-plug), moveable so as to allow of access to the sparking-points from the outside. An ordinary ignition-tube may also be fitted to the barrel, so that either tube or electric ignition may be used; and the tube may be shut off from the cylinder, when required, by another plug or cock, or by the one E first described. This latter may also be used for allowing compressed air or vapour to escape from the cylinder, so as to reduce the compression at starting, and also to remove deposits of carbon from the sparking-points, while the motor is running. For this latter purpose, the passage F is preferably restricted near the sparking-points, in order to obtain greater velocity of the gases in their passage between them.

Working and Regulating Gas-Motors.—Abel, C. D.; a communication from H. Eckhardt, of Berlin. No. 16,509; Aug. 14, 1899.

In gas-motor engines of known construction (the patentee remarks), the combustible charge drawn into the cylinder remains in contact with the hot walls during the suction and compression strokes, whereby it is subject to a considerable increase in temperature, which "unfavourably reduces the weight of the charge for each cycle of strokes, and renders it necessary to limit the degree of compression to considerably below the most advantageous end-pressure in order to prevent premature ignition." The present invention relates to a method of operating and an arrangement of parts whereby this disadvantage (which is more particularly felt in large motor engines) is said to be obviated.

For limiting as much as possible the interval of time during which the gas and air mixture is exposed to the action of the hot walls of the engine cylinder, the combustible charge is drawn into a special mixture-pump, and is subjected to a preliminary compression to as high a degree as is possible in an intermediate chamber. By cooling this mixture-pump, or the intermediate chamber, a greater or less isothermal condensation can be obtained. The mixture, thus initially compressed, is led into the engine cylinder from the intermediate chamber, towards the end of the return stroke of the piston, without appreciable reduction of pressure; and it is there subject to the required degree of end-compression by the remaining part of the piston stroke. The ignition of the charge and its expansion then takes place in the usual manner. By thus introducing the combustible mixture into the engine cylinder at a comparatively high initial pressure, the instroke of the working piston which follows the working outstroke can be almost entirely utilized for expelling the combustion gases, whereby the engine can, without difficulty, be arranged to work as a two-stroke-cycle engine.

The cylindrical-guide A is utilized as the charging-pump of the engine cylinder B, in the manner described in patent No. 11,263 of 1899. This pump draws in the combustible mixture, and forces it into the chamber C, which is made of such a size that the pressure of the charge therein is



about equal to one-half the end-compression pressure produced in the engine cylinder. In the latter, the expelling period commences at about nine-tenths of the outstroke of the piston, at which moment the discharge-valve E is opened. The closing of this valve is only effected at about 70 to 80 per cent. of the instroke of the piston; and, in consequence, the engine piston is enabled to expel the combustion gases of the previous working charge from the cylinder B during nearly the entire instroke.

Immediately after the closing of the discharge-valve E, the inlet-valve D for the combustible mixture (which is worked with a positive motion) is opened; and the initially compressed charge now flows from the intermediate chamber C into the engine cylinder B. As soon as an equilibrium of pressure is established in these two spaces, the inlet-valve is closed; and the engine piston during the remaining portion of its stroke brings the charge up to the required degree of end-compression.

At the dead-centre, ignition is effected in any suitable manner; whereupon the combustion and expansion period continues during about nine-tenths of the out-stroke of the piston.

The sooner the gas-mixture admission-valve D is opened, the greater will be the quantity of mixture passing into the engine cylinder, and the higher will be the compression and combustion-end pressure therein. On the other hand, by retarding the opening of the valve, the weight of the charge admitted to the cylinder will be correspondingly reduced. By this means, a convenient method of regulating the power of the engine, by varying the time of opening the inlet-valve, is provided.

With gas-motor engines that require to be worked with comparatively large charges (such as engines operated by generator or blast-furnace gas), the effectual expulsion of the combustion residues from the engine cylinder may be assisted by introducing into it, at the commencement of the expelling stroke, a strong jet of clearing air, and allowing this to act until the discharge-valve is closed, and the introduction of the initially compressed new charge begins.

Generating Acetylene.—British Pure Acetylene Gas Syndicate, Limited, and Talbot, C. E., of Liverpool. No. 18,556; Sept. 14, 1899.

This invention relates to the class of acetylene generator in which the calcic carbide is allowed to fall into an excess of water—such, for example, as the generator described in patent No. 18,207 of 1896 (granted to Raoul Pierre Pictet); and the object aimed at is "to improve this class of generator, by preventing the escape of the gas generated as the carbide passes through the water in the shoot leading to the generating chamber,

PREPAYMENT METERS.

CHANGING PRICE.
MOST SIMPLE.
NO WHEELS OR PARTS REQUIRED.

THIS METER CAN BE ALTERED *in situ.*

INSTRUCTIONS.

The Brass Plate has holes around its edge, numbered; these indicate the feet delivered for the Coin used To set the Meter, note Figs. I., II., III., IV.

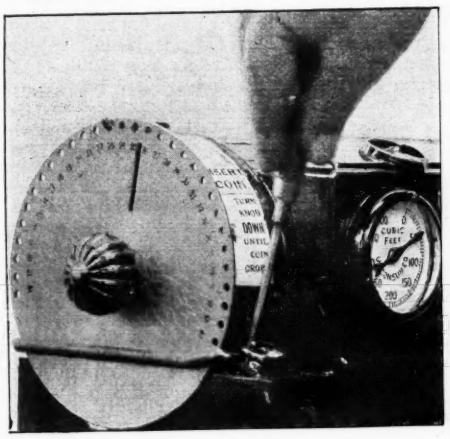


Fig. I.
Break Company's Seal and Remove Screw—THUS.

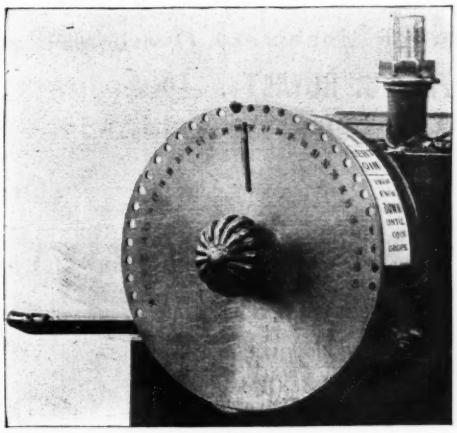


Fig. II.
Swing Band Back—THUS.

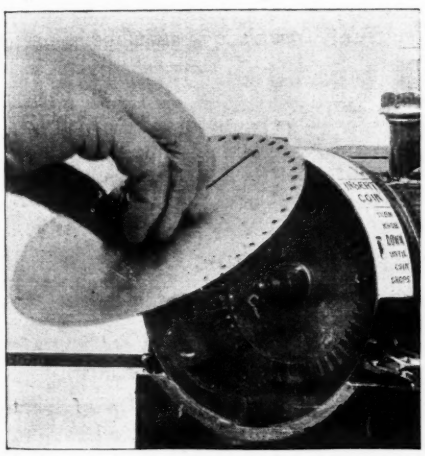


Fig. III.
Lift Plate Off—THUS.

Fig. IV.
Replace Plate—THUS.

Swing Band Forward—Replace Screw—and Re-seal.

NOTHING SO EASY. NOTHING SO ACCURATE.

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A "NEEDFUL" EXPLANATION.

We note an Advertisement in the "JOURNAL," under the name of the NEW CONVEYOR COMPANY, stating that they had taken over the business of the AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED; and, as it may create a false impression, we beg to say there are **NO VALID PATENTS** existing in connection with Inclined Retorts (beyond a few small and subsidiary ones, dealing with details).

We are prepared to erect Inclined Retort Plants, with Conveying and Elevating Machinery, Overhead Tanks, Hoppers, and Measuring Chambers, complete and **FREE OF ROYALTY.** In the list of places given, only a few were erected by the New Conveyor Company—nearly all the remainder being erected by the undersigned.

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WINSTANLEY COMPANY, COVENTRY.

BRADDOCK'S PATENT PENNY-IN-THE-SLOT

(ALSO SHILLING-IN-THE-SLOT)

PREPAYMENT WET AND DRY GAS-METERS

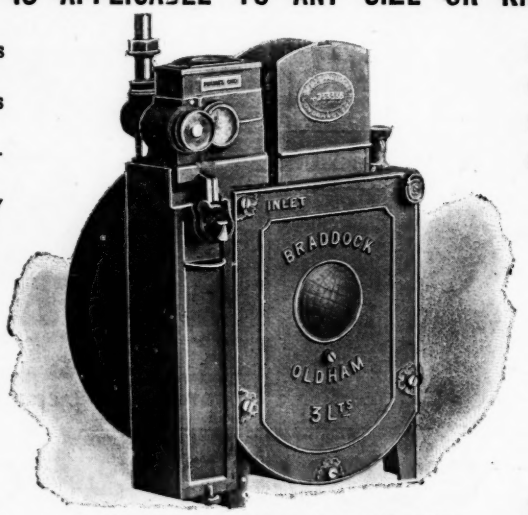
STRONG AND DURABLE. SIMPLE, YET EFFECTIVE.

THE ATTACHMENT IS APPLICABLE TO ANY SIZE OR KIND OF GAS-METERS.

The Attachment is kept as distinct from the Meter as possible, and does not interfere with the ordinary Index of the Meter.

METER REPAIRS ARE NOT COMPLICATED.

NO DELICATE PARTS.



No. 222. BRADDOCK'S CAST-IRON CASE WET PREPAYMENT METER.

By the patent arrangement of Crown Change Wheel and fixed long Pinion, the price may be very readily altered *in situ*.

Any number of Feet per Penny may be allowed.

MOST CONVENIENT AND DEFINITE SYSTEM.

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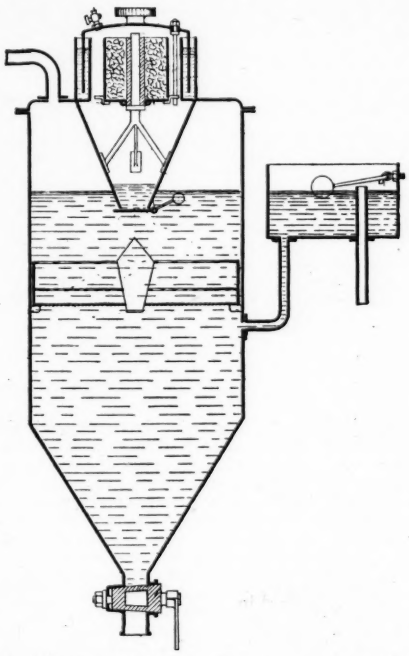
Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 248 HOP.

by preventing the loss of gas due to solution in the main body of water, and by certain modifications in the structure of the generator."

As shown, the acetylene generators are constructed as follows: The main body of the generator consists of a cylindrical tank with a conical bottom, the apex of which is closed by a sludge-cock. The tank is partially filled with water, the level of which is maintained constant by a cistern and ball-tap, or other convenient means. The charging chamber is carried from the top or cover of the tank; the portion above the cover having a double wall which forms a deep annulus. The lower portion



of the charging chamber (which passes gas-tight through the cover of the tank) is of conical configuration, and extends so that its apex is just below the water level in the tank; and the opening at the apex is closed by a hinged and counterweighted flap, which normally closes the opening. The charging chamber is closed at the top by a bell-shaped cover, whose deep rim enters the annulus, which is filled with water, and so forms a water seal.

A central fixed spindle is carried by arms from the conical part of the charging chamber; and on the spindle is supported a cylindrical carbide container, divided into four or more separate compartments by radial walls—suitable means being provided to prevent the rotation of the container. The container has an open top, but the bottom of each compartment is provided with a separate hinged door. Each door is normally held closed by a catch; and the catches are adapted to be released in succession, as the bell-shaped cover is rotated. In the tank, and at a level slightly below the counterbalanced flap, a series of transverse grids are supported. The uppermost grid has a coarse mesh; the next grid a somewhat finer mesh; and so on to the lowermost grid, which has the finest mesh. At the centre of the grids is a conical spreader, which serves, as the carbide falls through the flap, to spread it out circumferentially on to the upper grid.

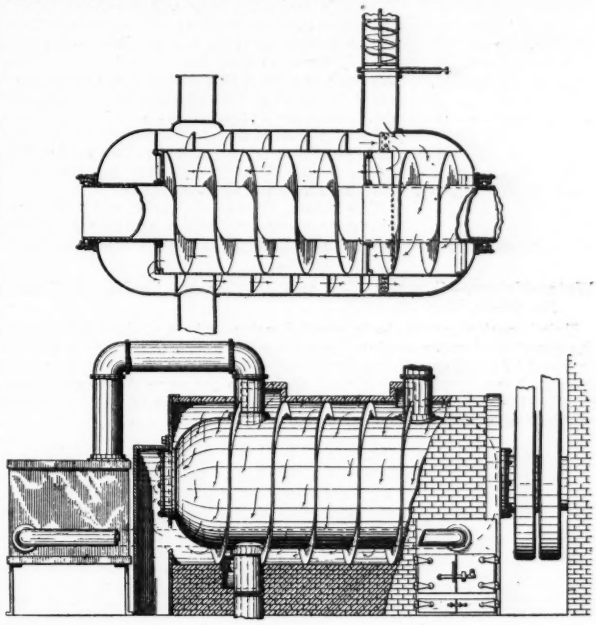
The action of the generator is as follows: When charged, the carbide container is placed in position on the central spindle, and the bell-shaped cover is inserted in place—the vent-cock being opened to allow the air to escape. On giving the cover (say) a quarter turn, the catch of one of the hinged doors is released by a projecting arm on the bell-shaped cover, which allows the carbide in one of the compartments to drop on to the hinged flap. It is thus opened, and so allows the carbide to fall on to the uppermost grid, on which it is spread out. The hinged flap is then closed by its counterweight, which prevents the escape of gas. The larger pieces of carbide are supported by the upper grid; the other portions passing through on to the second grid (of these, the larger pieces are intercepted by the second grid), and so on.

The acetylene liberated from the carbide on the lower grids prevents any caking of lime on the larger pieces on the upper grids, and causes the lime to rapidly fall through into the large volume of water below; and as the water is at rest, the lime rapidly settles to the bottom of the cone, and can be drawn off by the sludge-cock. As soon as the carbide in the first compartment is exhausted, the cover is rotated another quarter turn, the next compartment is emptied, and so on.

Revolving Retorts.—Johnson, G. W.; a communication from H. Spurrier, of St. Henri, Quebec. No. 18,825; Sept. 18, 1899.

This invention relates particularly to retorts for use in the destructive distillation of sawdust, although they can be employed in the manufacture of coal gas, and for other purposes. The patentee states that his object is to provide means whereby the substance to be distilled, during the process of distillation will be kept in a constant state of agitation, and each particle be brought at intervals into the area of the greatest heat, "at the same time providing for the most effective collection of the bye-products, and the uniform feeding to the retort of the sawdust." The best results are said to be obtained by dividing the chamber or main compartment into a number of sub-chambers or smaller compartments, and causing the substance being treated to circulate from one to the other and alternately through each of the compartments. Better results are claimed to be obtainable from retorts on this principle, "for the reason that the material being treated is always divided (each portion being completely separated from the other); thus enabling one portion to be agitated to a greater degree than the other portions of the material, and be continually, during treatment, subjected to different temperatures."

The retort (as shown) is completely enclosed in a furnace, the side walls and top of which are built of brick, the ends of cast iron, and formed with bearings—one provided with an opening or flue. A cast-iron box is bolted to this end, and encloses the flue to a point above the bearing. A brick-work bed supports the retort, through the medium of a spirally-arranged vane, which is of sufficient width to extend completely across the space between the retort and the interior of the furnace-casing. This vane provides a spiral flue extending from the fire-chamber at one end of the casing to the box at the opposite end; while access to the fire-place is obtained through the fire and ash-pit doors respectively, carried by a cast-iron frame, which also has an opening to receive the end of a pipe through which the gases are fed to the fire-place.



A condenser is situated near to the end of the furnace, communicating through a pipe with the adjacent end of the retort. The opposite end of the condenser communicates with the fire-place by means of the first-mentioned pipe; while a third pipe leads from the bottom of the end next the retort, through the bed, to a water-tank.

The stationary outer cylinder of the retort consists preferably of a tubular section having hemispherical ends bolted to it. These ends are formed with bearings, in which rest the tubular trunnions (in the form of a sleeve) of the open ended inner rotary cylinder, and one end of a hollow shaft, or tube, which extends from the cast-iron box through the hollow trunnion into the chimney. A pulley is attached to the tubular trunnions, and a helix is secured on the exterior of the inner cylinder; the vanes being of sufficient width to allow of their radially outer edges rotating in close proximity to the inner surface of the outer cylinder. The hollow shaft, or tube, has a pulley fastened to it.

An open-topped horizontally-arranged cylindrical section of corresponding diameter to the inner cylinder is rigidly secured to the interior of one end of the outer cylinder by an angular strip riveted at its side edges respectively to the interior of the end of the outer cylinder and to the adjacent end of the cylindrical section. The trunnion is of sufficient length to extend a short distance within the inner cylinder, to which it is rigidly connected by a spider at the inner end, while a second spider maintains the other end of the cylinder (to which it is firmly connected) in its proper position relatively to the hollow shaft. A left-hand helix is secured on this trunnion; its convolutions extending from end to end of the portion within the cylinders, while the inner end is connected to one edge of one of the spider arms, which are set in a plane corresponding to the plane of the helix. A third helix is carried rigidly by the hollow shaft, and extends from end to end of the cylinder, the interior of which it closely fits.

Two vanes are secured by angle-braces upon the exterior of the inner cylinder, diametrically opposite to one another, and at the end adjacent to the open-topped cylinder, along the full length of which they extend.

The surface of the outer cylinder is formed near one end with a dome-like extension, to the upper end of which a pipe is connected to conduct the gases to the condenser; this pipe having a perforated diaphragm secured transversely through it.

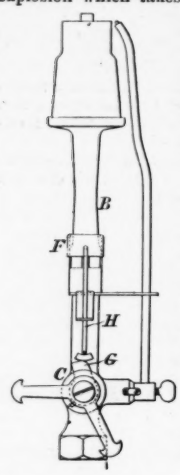
A supply-pipe, having a helix mounted therein, and driven from any suitable source, is connected adjacent to the other end of the outer cylinder. It preferably communicates at its upper end with a hopper to carry the supply of sawdust or other material to be distilled; while the discharge-pipe before mentioned enables the residue, after the distillation has been effected, to be discharged.

Gas and Other Fluid Cocks.—Dickinson, G. W., and Garlick, R. H., of Manchester. No. 24,261; Dec. 6, 1899.

This valve or cock is provided with a taper plug having a hole through the centre lengthwise; also a hole across the diameter and in connection with the first-mentioned hole. One end of the plug is formed so as to be able to be connected by a screw thread to ordinary gas or other piping. The other end of the plug is connected to a tap for regulating the quantity of gas passing through in a given time—a barrel being made to fit the plug so as form a swivel, and the barrel having connections for taps to regulate the quantity of gas supplied.

Incandescent Gas-Burner.—MacKean, W., of York Street, Westminster. No. 20,641; Oct. 14, 1899.

In order to prevent damage to mantles by the shock of the momentary explosion which takes place when the flame is lighted or extinguished, the patentee proposes to so arrange the burner and its stopcock that, in the act of turning on the gas and lighting the flame, the supply of air is cut off, or so far reduced that the gaseous mixture is not of an explosive character, but only becomes so after ignition is effected and the gas is fully turned on. Again, in the act of extinguishing the flame, the mixture is first rendered inexplosive, and then the gas is turned off.

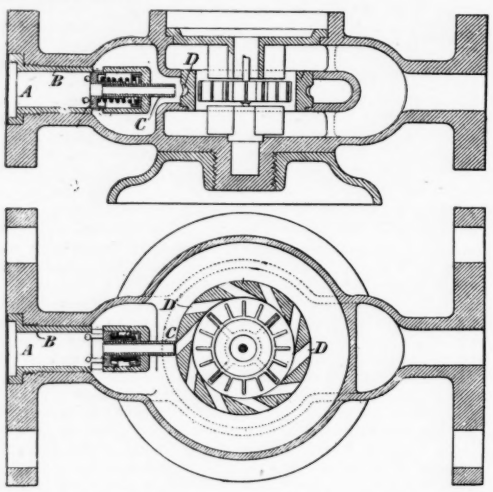


This is effected by using a burner of the form shown. On the burner-tube B is fitted a sleeve F, which can slide over and cover the lateral air-inlets; and on the plug of the gas-cock C is a cam projection G to operate on the end of a rod H, which is attached to the sleeve. When the cock is closed, the air-inlets are covered by the sleeve; and it is not until it is fully opened, and the flame lighted, that the inlets are fully open. In like manner, in turning back the plug of the cock for the purpose of extinguishing the flame, the air inlets are closed by the descent of the sleeve before the gas is fully cut off.

The sleeve, instead of having only its own weight to cause its descent as the plug of the cock is turned, might be urged down by a spring.

Water-Meters.—Gernuitz, W., and Beschorner, A. M., of Vienna. No. 9285; May 19, 1900.

This invention relates to inferential water-meters, of the kind wherein the quantity of water passing is deduced from the velocity of a turbine actuated by the flow. It has for its object to render such meters "more sensible than heretofore, so that they also measure flows which are smaller than would correspond to the cross-section of the water-way within the instrument."



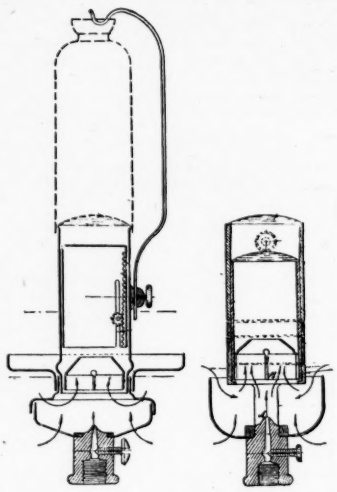
This purpose is attained by interposing (as shown) in the admission neck of the meter a casing, which forms a diaphragm or cross partition, and from which a narrow pipe extends to the outer end of one of the inclined passages formed in the turbine casing. The diaphragm casing has its sides provided with openings, the total area of which is equal to the cross-section of the water-way, and which are kept closed by a slide-valve or by a clack-valve. Where a slide-valve is used, it is loaded by a spring and connected with a piston, one face of which is exposed to the pressure of the water. If clack-valves replace the slide-valve, they are conveniently loaded.

In the case of small flows, there is always a jet of water issuing from the narrow pipe; and as the jet immediately passes into one of the inclined passages of the turbine casing, it is capable of turning the wheel. When there is a strong flow, the slide-valve is displaced by the pressure of the water on the piston, or the clack-valve is opened in the same way, so that the water is allowed to pass through the openings in the sides of the cap-shaped diaphragm.

The cylindrical cap B is so screwed into the admission neck A of the meter that it forms, within the neck, a cross partition or diaphragm. From the bottom of the cap, a narrow pipe C extends into the immediate vicinity of one of the inclined passages D, formed in the casing of the turbine. The sides of the cap are provided with perforations or ports controlled by an annular slide valve made integral with a piston adapted to work within the cylindrical cap B, and to slide along the extension pipe C inside the cap. A coiled spring tends to keep the piston and valve in their rearmost position, in which the valve closes the ports. When more water flows in than can pass through the pipe C, the pressure of the water pushes the piston forward, whereby the ports are opened, so as to allow the water to pass through them.

Burners for Incandescent Gas Lighting.—Delin, G., of Brussels. No. 11,369; June 22, 1900.

This incandescent gas lighting burner is provided with a mixing-chamber, divided by a wire-gauze partition and a coned nozzle or efflux-tube; the chamber being thus divided into three compartments, the heights of which are adjustable to suit the richness and pressure of the gas by shifting the upper and intermediate wire-gauze partitions so as to quicken or retard the passage of the gaseous mixture. The burner is also provided with a closing-in device surrounding the gas-supply jet, by which the gas-flame is prevented from flickering, "due to the fluctuations of the surrounding air," and which at the same time allows the admission of air for combustion.



The mixing-chamber of the burner (as shown) is provided at its upper end with a wire-gauze partition, at the place where the combustion of the gas takes place. This chamber is divided into three compartments by a lower wire-gauze partition, and a hollow-coned nozzle or efflux-tube. These latter are intended for intimately mixing the gas and air for combustion; but, in order that the mixing may be perfect, it is necessary that the capacities of the three compartments of the mixing-chamber can be regulated. To this end, the cylindrical-shaped portion of the nozzle is split or slit, so that the sections thus formed on the cylinder may act as springs, and press slightly against the inner wall of the tube. By this means, the tube may be fixed in place at any convenient height, and its position can be varied as desired. The conical-shaped portion of the nozzle is intended for retarding the flow of air and gas, the direction of which is indicated by the arrows, so as to obtain an intimate mixing.

The left hand form of burner has a regulating device for adjusting the intermediate wire gauze or perforated metallic sheet relatively to the upper wire gauze or diaphragm, which is stationary. The tube of the diaphragm contains a rack, which engages with a small pinion, the spindle of which extends through a slot in the tube, and is turned by the milled head. In the other form of burner, the lower gauze diaphragm is stationary while the upper one, and consequently the space between them, are regulated by means of rings of convenient breadth, arranged as a support for the tube of the lower wire gauze. These interposed rings afford the advantage that, regulation once made for any place to be lighted is made permanent, so that adjustment will not be required again.

APPLICATIONS FOR LETTERS PATENT.

15,204.—Tolson, J. E., and Haigh, D., "Gas-generators." Aug. 27.

15,229.—Dodillet, R., and Bergmann, E., "Turbines for steam, water, or gas power." Aug. 27.

15,242.—Potter, W. G., "Incandescent gas and vapour lamps." Aug. 27.

15,292.—Titus, E. S., "Production of acetylene gas." Aug. 28.

15,315.—Sugg, W. T., "Compressing gases." Aug. 28.

15,341.—Wernert, C. F. J., "Registers for gas-meters." Aug. 28.

15,393.—Bradley, W. H., "Gas-producers." Aug. 29.

15,408.—Margreth, J., "Actylene gas generators." Aug. 29.

15,452.—Spooner, A. F., "Carburetters." A communication from A. Orlandi and J. B. Penne. Aug. 30.

15,455.—Kershaw, H. B., "Heating, cooling, or condensing liquids or gases." Aug. 30.

15,462.—Turner, B. M., and Smith, R. T., "Mixing air and oil gas, or other combustible fluid, for use in oil gas and like motors." Aug. 30.

15,501.—Fletcher, T., Neil, A., and Fletcher, Russell, and Co., Ltd., "Burners for gas." Aug. 31.

15,526.—Potter, W. G., "Compressing gas for incandescent street and other lighting." Aug. 31.

15,536.—Evans, E., "Generating acetylene gas." Aug. 31.

15,545.—Bohr, J., "Regulators for gas-burners." Aug. 31.

15,550.—Martini, A., "Gas-igniting devices." Aug. 31.

15,645.—Kurz, F. K., "Carburetting a gas by the vapour of a liquid." Sept. 3.

15,654.—Murray, E. F., "Acetylene-engine." Sept. 3.

15,658.—Powel, H. C., "Gas and petroleum engines." Sept. 4.

15,682.—Brooks, F. M., "Bunsen burners." Sept. 4.

15,712.—Jennings, W. E. A., "Governor and enricher of gas." Sept. 4.

15,731.—Kommanditbolaget Svensson & Cis. Acetylenaffär, "Generator for acetylene gas." Sept. 4.

15,797.—Abel, C. D., "Two-stroke internal combustion engines." A communication from the Gasmotoren Fabrik Deutz. Sept. 5.

15,801.—Hastings, G., "Acetylene gas generator." Sept. 5.

15,813.—Lazareff, P., "Manufacture of combustible gases from hydrocarbon liquids." Sept. 5.

15,869.—Rea, S. W., "Explosive engines." Sept. 6.

15,886.—Carter, W. T., "Internal combustion motors." Sept. 6

15,892.—Frost, H. H., "Fluid meters." Sept. 7.

15,966.—Kowalsky, P., "Testing gas-pipes and the like." Sept. 7.

15,974.—Milne, J., and O'Connor, H., "Coin-freed gas-meters." Sept. 8.

16,012.—Gaster, L., "Treatment of tar pitch residues for extracting carbon suitable for electrical purposes." Sept. 8.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Allowance to be Made for Fast and Slow Meters.

SIR,—Your correspondent, "Gas-Meter," is evidently misinformed. A tester passes his 100 cubic feet (or maybe 5 feet) through the meter in dispute, and makes his reading on the test-meter. This, of course, makes your correspondent's letter unnecessary. It is hardly likely that a tester would try to make his reading on an ordinary meter or that the company would make an error in all cases against them.

B. P. P.

SIR,—I have to thank "Gas-Meter" for bringing forward a matter in which I have taken more than ordinary interest, and respecting which I was rather puzzled a few years ago.

"Gas-Meter" points out that the meter in his example is "12 per cent. fast according to custom." But that is not so; and I do not think it would be according to custom to so state the error of the meter.

In passing 100, the meter tested registered 112—making a plus error of 12. It is, therefore, 10·71 per cent. fast. On the other hand, in passing 100, the meter tested registered 88; and is therefore 13·63 per cent. slow. Taking 112 as an exemplary consumption, the adjustment works out thus—

Fast: 10·71 per cent. of 112 = 12. Then 112 − 12 = 100 = the correct measurement and quantity to be charged.

Slow: 13·63 per cent. of 88 = 12. Then 88 + 12 = 100 = the correct measurement and quantity to be charged.

I always test my meters thus, and with the following results: Test-meter, 11·2. Meter tested, 10 = 12 per cent. slow. Then, taking 10 as the exemplary consumption, we have 10 + 12 per cent. = 11·2 = correct measurement and quantity to be charged. This example does not agree with some tables I have seen, but which I cannot trace.

W. H. A.

Sept. 14, 1900.

SIR,—In regard to the above question, I beg to say your correspondent has been misinformed. He says he understands it is the custom to pass 100 cubic feet of gas through the test-meter, and if the meter registers 112 feet it would be called 12 per cent. fast. Now if meters were tested on this system, the figures which follow would be correct; but as they are not tested in this manner, the statement is misleading.

It is usual to have a correct instrument to test gas-meters with, generally a small holder; and it is by this that the amount of error is decided. The method is this: The meter is set to a definite point on the test finger of the index. The holder is then set to zero; and when the finger of the meter being tested has made a complete revolution—say 5 or 10 feet as the case may be, according to the size of the meter being tested—a reading is taken on the test-holder. This gives the amount of error; and in making allowances for error, it follows that the quantity fast or slow must be taken or given on the exact amount registered by the meter.

J. TEMPLETON.

Leeds, Sept. 14, 1900.

Testing the Soundness of Gas-Mains.

SIR,—I have recently laid about 700 yards of 24-inch gas-main; and after connecting it with the governor-house mains by a temporary 10-inch connection, and before blowing out the air prior to connecting the end distant from the works with the live mains, I determined to make a careful test of the soundness of the joints, and the main generally.

A recording pressure-gauge was connected to it by means of a ¾-inch wrought-iron pipe at about 5.30 p.m. some few weeks ago. The diagram the following morning showed that the pressure had been perfectly regular at zero; but on again examining the gauge at 5.30 p.m. the same evening, I found that the pressure had gradually risen from 11 a.m. to about 20-10ths. This I attributed to the very hot sun during midday. I then decided to leave the gauge another day; and, much to my surprise, the next morning I found that the pressure had risen to 45-10ths, which afterwards I found to have been caused by the blacksmith fitting a key to the valve on the temporary 10-inch connection at the time when the pressure began to rise. I immediately had the valve closed, and about 10 feet of the 10-inch main adjoining the valve flooded with water, so as to render any further trouble from this source impossible. The gauge was still kept in the same position; and gradually the pressure dropped until, two days after the main was flooded, the gauge again stood at zero. But on the third day there was a vacuum of 4-10ths in the main; on the seventh day a vacuum of 20-10ths; and on the fourteenth day a vacuum of 52-10ths. This vacuum has continued now for four weeks at about 4 to 6 inches.

The only explanation I can offer is that, owing to the diffusion of the gas in the main at a greater rate than air can take its place, a vacuum has been set up. I invariably test all new mains immediately after they are laid; but I must confess that this is a new experience to me, and I should be glad of the opinions of some of your readers on this matter.

"PERPLEXED."

Sept. 15, 1900.

Halifax Corporation Gas and Water Supply.—The accounts of the Halifax Corporation for the year ended March 31 have just been issued by the Borough Accountant (Mr. James Nicholl). The income from the gas-works amounted to £110,681, and the expenditure to £92,489—a difference of £18,192, as compared with £16,340 in the previous year. The expenditure on the water-works was £47,706; and the income, £51,180—leaving a balance of £3474. From 1856 to 1888, a sum of £86,635 was transferred from the borough fund to make up deficiencies in the water-works revenue. From 1886 to this year, £76,027 has been transferred from the water-works revenue in aid of the borough fund. The net loss to the ratepayers so far, therefore, is £10,608. Formerly interest was added at the rate the Corporation were paying, but since 1896 this has been discontinued. Had interest been still reckoned, the adverse balance would be some £80,000 more. The assets of the Corporation amount to a total of nearly £3,000,000, and include £764,508 for water-works and baths, and £554,348 for gas-works.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Ninety-first Half-Yearly Meeting of this Company was held last Tuesday—Sir FREDERICK T. MAPPIN, Bart., M.P., in the chair.

The GENERAL MANAGER AND SECRETARY (Mr. Hanbury Thomas) having read the notice convening the meeting, the report of the Directors—which was summarized in the "JOURNAL" for the 21st ult., p. 478—was taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the net profit for the half year had been £50,001; and after the payment of dividend and interest on debenture stock, it left a balance of £6905 to carry to the balance in hand, the total of which now stood at £28,851, a position which made it, in the present state of the market for coal and other material, a very satisfactory asset. He was afraid, however, that it would not be of the same amount at the end of the present half year. The reserve fund (amounting to £86,848) was at its maximum; and the result of the working had been as follows: The receipts for gas had been £4693 more than they were in the corresponding half year of 1899; for coke, more by £10,709; for tar, £3544; and for fittings, £541; while the expenditure had been less for the repair of works by £1604; and for the repairs of mains and services less by £2615. The Company had been able to curtail their expenditure in these two items very much, because they had expended their money very freely upon them in years past, when materials were lower. On the other hand, their expenditure for coal had been £13,154 more than in the corresponding half of 1899; so that they had already felt very materially the increased price they had to pay for coal. Purifying materials and wages had been more by £653. They had also had some misfortunes, or, at all events, they had felt the result of misfortune which had previously occurred. Their receipts for sulphate of ammonia, although the price had been high, had been less by £2125. He must explain how this occurred. The shareholders were aware that in December, 1899, they had a serious fire at the sulphate works; and although they were fully insured for the damage that was done, they could not make a claim for the loss which was incurred afterwards, and they had had to buy acid instead of making it. This had entailed an extra cost of £1457. Again, they had had also a serious expenditure with leakage in their liquor tank at Grimesthorpe. This tank, 150 feet long by 50 feet wide by 20 feet deep, was unfortunately not made sufficiently strong in construction to resist the pressure upon it; and the loss of liquor suffered thereby had been of the value of £491, while he was afraid that the repairing of the tank would cost four or five times that amount. Then they were unfortunate in having broken pipes on two different occasions at Neepsend, entailing a loss of liquor to the extent of £596; so that their receipts from sulphate of ammonia had been materially affected. Though they had suffered this loss, yet the financial position of the undertaking was, he thought, in no way prejudiced. Their consumption of coal during the past six months had been large, amounting to 130,446 tons. The Directors had felt that, in the face of the large advance in the price of coal they had had to provide for during the coming year, they were compelled to increase the price of gas; and they had done so by putting on 4d. per 1000 cubic feet. This increase would not by any means meet the entire extra expenditure upon coals; yet the Directors hoped it would go a long way towards it. The leakage had been 50,648,000 cubic feet, equal to 3·76 per cent., against 4·34 per cent. in the corresponding half year of 1899. The increase in the consumption of gas was still going forward; and up to the present time this half year, they had sent out 27,347,000 cubic feet, equal to 8·6 per cent., more than during the same period in the corresponding six months. He wished to refer to the incandescent gas-light, and the mode of dealing with it; for in his opinion it was the most economical of all artificial lights in the world. The Welsbach Company had made sweeping reductions in the prices of burners and mantles; and he thought this would ensure the incandescent light being used in greater quantities than it had been before. Everyone who understood that these Welsbach burners only consumed from 2½ to 4 cubic feet of gas per hour, and gave a light equal to from 40 to 80 candles, would, he thought, see the desirability of applying them wherever possible. If they did not, they would not be doing good business and using the best article in the best way. Even at the present increased price of gas in Sheffield, a Welsbach burner consuming 4 cubic feet per hour, cost only 1d. for ten hours. Incandescent gas-light was about as perfect as working hands could make it. The future was, in his opinion, very satisfactory for all gas undertakings. The British Westinghouse Electric and Manufacturing Company were about to establish works in Manchester, to make gas-engines. Mr. George Westinghouse believed that gas-engines would be the most generally used prime movers of the future; and he was a man whose opinion all would recognize as the best and most reliable. The Westinghouse people evidently believed that within a short time gas would be produced in England and Wales at a price far below that which now prevailed in any part of the world. He quite endorsed this opinion; and he would give his reasons for it. Mr. Webber lectured at the Royal United Service Institution in June last, to the Incorporated Gas Institute, on what he called "The New Gas;" and in the course of his lecture, he said: "Come to Germany, where I will show you things that shall be here in due course. It so happens that Germany did not give the Welsbach or the Auer system any patent monopoly whatsoever (as England did). The result has been that the system has for years been worked there, on all hands, strictly on a commercial basis. The manufacture of mantles, burners, and all the accessories, had progressed enormously; and the whole trade was far more advanced and important than it was in any country where a patent monopoly had kept it in one proprietorship. . . . There are half-a-dozen well-reputed makers of incandescent mantles for the German markets. The gas companies get them at from 1d. to 2d. apiece; and the burners cost 9d. A good incandescent lighting fitting, complete with mantle, burner, reflector, shade and Jena chimney can be fixed for 2s. 3d. by the gas companies; consequently German towns are brilliant with the brightest and cheapest light known." He might say something further on this subject. Dr. Auer's invention of the Welsbach burner had done this for Germany; and he

hoped it would do more for this country. In many parts of Germany they were using gas at the present time of from 7 to 9 candle power, which almost compelled the consumers to use incandescent burners. With these burners and mantles, they obtained as good a light as we did in England with our 16, 17, and 18 candle-power gas. Using 3·67 feet per hour with these burners in Germany, the consumer obtained a light equal to 73·66 candles. Parliament would, in his opinion, in the near future pass a Bill that would enable gas companies in this country to have more liberty, more freedom, and which would no longer require them to use the expensive coal and other enriching materials they employed at the present time to keep up their standard of gas to what they had been accustomed to supply. Consumers had the matter in their own hands, if they used the best burners for producing a good light; but if they persisted, as they had done hitherto, in using burners for years, without being at the trouble to exchange them, they must suffer. If, however, an alteration was made in the quality of the gas, then, in his opinion, they would be compelled to use incandescent burners. In Munich, they had replaced the electric arc lamps in their streets by 7000 Welsbach gas-lights. In Berlin, they had replaced arc lights with 35,000 incandescent Welsbach burners, and the principal streets of Paris were lighted in the same way. Liverpool, also, had found electricity too expensive for street lighting; and although the city owned the electric light works, the Council had arranged with the Gas Company to supply the streets with incandescent gas. He was sorry to see the other day that the Sheffield Highway and Sewerage Committee considered it advisable to have the electric light at the sewage works, and that they had instructed the City Surveyor to report as to cost, and to obtain tenders from the Electric Lighting Department. Surely the Sheffield Council were not going to spend the ratepayers' money in such an extravagant way. The experience throughout the kingdom was that arc lights were being given up. He maintained that for the Sheffield sewage works gas-light, at a quarter the price, should be good enough for an undertaking of that kind. The first step in the direction of legislation to permit the reduction of the quality of the gas was the passing of a Bill of the South Metropolitan Gas Company this year, which enabled the Company in the future to supply gas of 14-candle power, instead of 16 as heretofore. The passing of this Bill would be the nativity of a cheap gas supply; and it was the result of Mr. George Livesey's enterprise, and of his common sense. The Sheffield Gas Company were now supplying Welsbach burners, with chimney and mantle complete, for 3s. 6d.; and the mantles were only 7½d. each. They also employed men to pay fortnightly visits to any consumer who had these lights, and who would pay 4d. per light per month for the attention given, which included new mantles when required. He was sorry to say that the Company's troubles with naphthalene had been very great again this year—not so great as in 1899, but certainly a source of much anxiety and worry. Their efforts had not been relaxed in endeavouring to cope with the difficulty. Only in the last three weeks, however, had they had much confidence in their hopes being realized, that they would find out the cause of the trouble. He believed they had now discovered it. They had found that the foul mains at each of the works, which were used for cooling the gas before it was sent to the purifiers, had all been placed inside the retort-houses; and during the hot weather they had not had the effect they should have had—in fact, they had cooled the gas very little. It was now believed that the naphthalene trouble had arisen from this. They had inquired what other companies were doing; and they had found that companies who were not troubled with naphthalene had most of their foul mains placed outside the retort-houses. Now that this had been discovered, he had confidence that in the near future they would master the naphthalene difficulty, and thus reduce trouble and anxiety that not the Company only, but also consumers in many parts of the city had experienced.

Mr. Ebenezer Hall seconded the resolution.

Mr. John Wilson asked whether the Directors had had before them the question of adopting penny-in-the-slot meters, of which he understood that over 100,000 were in use successfully in the South of London, to the great advantage of working-class consumers.

The Chairman replied that he did not think there was any other city in England that had as many 2-light meters for gas consumers as Sheffield. There were more than 30,000 such meters, which were practically the same as penny-in-the-slot meters. The price of Sheffield gas was so low that there had been no application for the penny-in-the-slot system; and he did not think there was any call for it at present.

Mr. Hanbury Thomas mentioned that the companies who sold gas through slot meters added about 9d. per 1000 cubic feet to their ordinary price for gas delivered in this way.

The report was then approved, and the dividends recommended were sanctioned.

On the motion of the Chairman, seconded by Mr. H. K. Stephenson, it was decided to convert the 25,357 Class "F" £3 fully-paid shares, into £76,071 Class "C" stock.

The retiring Directors (Mr. W. G. Blake, Mr. R. A. Hadfield, and Mr. H. K. Stephenson) were re-elected; and the meeting ended with a vote of thanks to the Chairman for presiding.

HASTINGS AND ST. LEONARDS GAS COMPANY.

The report and accounts of the Hastings and St. Leonards Gas Company (which were noticed on the 4th inst.) were submitted at the recent meeting of the shareholders by Dr. Gray. In the course of his address, he said the last half year had been an exceptional one, especially for gas companies, owing mainly to the war and its direct and indirect effect upon business. Coal had gone up to such an extent as certainly never had been the case during his connection with the Company; and he believed that not since the Crimean War, when the Company obtained their first Act of Parliament, had it been so high, while, according to some authorities, it never had been at its present price before. This was due, as he said, largely to the amount of coal which had been used by the War Office for transports, to the scarcity of labour at the pit's mouth, consequent upon the calling out of the Reserve men, and to the large demand of industries owing to the impetus given them by the war. At the last meeting he told the shareholders that their contracts for coal, and for freightage, were, unfortunately, running out in June; and unless the price of coal fell, or unless there was a speedy termination of the war, they would have to renew contracts at a considerably increased rate, which would materially affect both the price of gas and the dividend. The result of renewing the contracts under the advance had been that they had to pay 80 per cent. increase on coal, which was equal to 9d. per 1000 cubic feet of gas. They also had to pay an increase of 6d. a ton on freightage, and the many commodities a Gas Company has to deal with. To meet the increased price of material, the Company had raised the price of gas, as from July 1, by 4d. per 1000 cubic feet. Dealing with items in the accounts, Dr. Gray pointed out that, under the heading of public lighting, there had been an increase of £65. They could not expect to have much in the future, because the Corporation had given notice to discontinue a considerable number of the lamps, which were going to be superseded by electricity. This meant to them no small loss in the supply of gas, as unfortunately they had to supply the lamps for the benefit of the town; and when they were discontinued, they were of no use. It would represent a loss of £800 to £1000 on what they had expended. If the Corporation had been called upon under similar circumstances to make a loss, there would have been a great outcry, especially as there was no need for the great outlay. It would be quite easy for the Company to supply an incandescent gas-burner giving a better and more diffused light, and at less cost than the Corporation would have to pay for electricity. Instead of this, they were doing away with gas, and superseding it with electricity, even at greater expense; and in order to get it done, they had to underestimate the cost of the work, and say it would be £13 or £14, when, as a matter of fact, they were charging £50 for existing lamps. Thus the Corporation were placed on the horns of a dilemma. They got out of the difficulty by saying that they had a white elephant, and must use it whether or not it cost more. The experience of large towns would some day be the experience of this; and the ratepayers would refuse to pay more than they could get as good an article for at another place. The report was adopted; and, among other business, the salary of the Secretary was increased £50 per annum.

AUSTRALIAN GASLIGHT COMPANY.

The Annual Meeting of this Company was held on July 30—Mr. George J. Cohen in the chair.

The Secretary (Mr. R. J. Lukey) having read the notice convening the meeting, the Directors' report was presented. It stated that the profits for the six months to June 30, after making provision for bad and doubtful debts, deducting interest on borrowed money, repairs and renewals, depreciation of plant, working expenses, and all other charges, amounted (with the balance brought forward) to £54,677; and the Directors recommended the payment of a dividend of 9s. per share, which would absorb £51,135, and leave a balance to be carried forward of £3542. The Company commenced supplying gas to the new district on the Milson's Point Line on May 24; but the unfavourable state of the weather of late had somewhat militated against the extension being availed of by intending consumers. To meet the great demand for "penny-in-the-slot" gas-meters, arrangements had been made for fitting up one hundred houses per week. As a result of the introduction of the meters, 5300 new consumers had already been added to the Company's books. The greater part of the carburetted water-gas plants for Sydney and Mortlake was to hand; and the remainder of the machinery was expected shortly. It was in view of these and other contemplated extensions that additional land was recently purchased at the Company's head station, from which half of the gas made is being supplied. The Engineer (Mr. T. J. Bush) reported that the Company's plant has been maintained in good condition.

The Chairman, in moving the adoption of the report, said that the past year had been a very satisfactory one, with the exception that the Early Closing Act had somewhat curtailed the consumption of gas—more particularly among small shopkeepers, many of whom had had to give up their establishments in consequence. With regard to the North Shore extension, he said the work was going on fast; and he hoped to be in a position at the next half-yearly meeting to say that the return on the outlay there was even greater than was anticipated. The penny-in-the-slot meters were in such demand that the Company intend to double their output during the next half year. The consumption of gas for the past half year had considerably increased; and these meters were accountable for the increase to a very large extent. The Chairman then went on to say the Company had no intention of transferring the machinery at the head station to Mortlake; on the contrary, new and extensive machinery for carburetted water gas manufacture was now in course of erection. The number of public street lamps was 10,313, showing an increase of 159 lamps for the half year. There were over 10,000 gas-cookers in use; and the number of consumers was stated at 43,216. The increase in the mileage of mains and service-pipes for the year was 96 miles; the total amounting to 1381 miles. In conclusion, the Chairman feelingly referred to the death of their late colleague (Mr. John Rae), who held a seat at the Board for twelve years, and was seldom absent from their meetings. Possessing a genial nature, his presence would be greatly missed by the Board.

The motion was seconded by the Deputy Chairman (Mr. S. Dickinson), and carried unanimously.

The eleven retiring Directors were re-elected, and Mr. A. A. R. Maxwell was elected in the place of Mr. Rae. The retiring Auditors were also re-elected.

A vote of thanks was carried by acclamation to the Directors and Officers of the Company for their efficient services during the past year.

The Gas Storage Question at Middlesbrough.—The question of gas storage at Middlesbrough (to which reference has been recently made in these columns) occupied the attention of the members of the Town Council in Committee for two hours last Wednesday. The points under discussion were whether a new holder should be provided, or No. 5 holder be repaired, and so avoid the expense of the former. Finally, it was resolved to instruct the Manager to continue taking the levels of No. 5 holder, and report to the Committee until further notice.

THE GAS SUPPLY OF TOKIO, JAPAN.

The Engineer of the Tokio Gas-Works, Mr. S. Hiramatsu, who is at present in England, where he intends residing for a few months, supplies an interesting statement as to the position and prospects of the Company.

He says: The Tokio Gas Company are, and will remain, the only establishment for gas supply in Tokio, the capital of the Japanese Empire, for the reason that circumstances do not admit the appearance of a rival. The city has more than 1,500,000 of population, and this is increasing year by year. The Company was established 25 years ago. At first its productive capacity was only 60,000 cubic feet per diem; it is now capable of producing 1,570,000 cubic feet—an increase of about 26 times. This increase has been accomplished by expansions effected on several different occasions. The last such extension work was begun in June, 1897, and completed in December last. It was the most marked; for by it alone the daily productive capacity was increased to the extent of 1,150,000 cubic feet. The demand for gas, however, is increasing by about 50 per cent. every year—chiefly caused by the increasing use of gas for cooking, heating, and in motors; so that the Company is compelled to make another large extension.

At present, the Company have three works, whose capacities are as follows: The first works is capable of producing 1,030,000 cubic feet of coal gas per diem. There are four benches of horizontal single retorts, each bench consisting of four arches of seven retorts; and a bench of inclined retorts, consisting of eight arches of seven retorts each. The holder capacity is 860,000 cubic feet. The second works has a daily productive capacity of 324,000 cubic feet. There is a bench on the old system, consisting of five arches of seven retorts, and a bench of inclined retorts of three arches of six retorts each. The holder capacity is 130,000 cubic feet. The third works is the most newly erected. It has a daily productive capacity of 225,000 cubic feet. There is a bench of inclined retorts here consisting of three arches of six retorts each. The holder capacity is 125,000 cubic feet.

These productive and holder capacities are altogether capable of meeting the demand till next winter, according to the past experience as to the rate of increase of consumption. In order to make the supply sufficient for the subsequent increase of consumption (which, as above mentioned, is striking), the Company have decided to undertake the following work in the course of the next five years: At the first works they will replace the four benches of single retorts with a carburetted water-gas plant of the capacity of 1 million cubic feet per diem. This plant has already been ordered of the Economical Gas Apparatus Construction Company. At the second works a bench of single retorts will be erected, consisting of six arches of seven retorts each. All the machines and apparatus required are to be utilized from those taken down at the first works. They will also add a retort to every arch of the inclined retorts, and replace the 20,000 cubic feet holder with one of 120,000 cubic feet. It is also intended at the third works to add a retort to every arch of the inclined retorts; to erect a bye-products plant to deal with the ammoniacal liquor and tar; to erect a coal-gas plant of the capacity of 700,000 cubic feet per diem; and to erect a holder of the capacity of 1 million cubic feet.

The situation of the works being remote from the "up town" section of the city, a gasholder of the capacity of 500,000 cubic feet is to be erected at a suitable point, in order to supply gas to the district; and pipe connections are to be made to each of the works, so that the gas from any of them may be stored and supplied there.

The cost of the extensions (including mains, services, meters, &c.) is estimated at *yen* 3,150,000,* and this sum is to be met with *yen* 2,100,000 accruing from a call on the shareholders and *yen* 1,050,000 of loan.

The Company is of opinion that another larger work of extension may yet become inevitable soon after the completion of the present undertaking, which it is estimated will not be for about five years.

Some figures from the accounts for the half year ended June 30 will be interesting: The coal carbonized amounted to 14,467 tons; and the gas made, to 145,088,100 cubic feet, or 10,029 cubic feet per ton. The quantity of gas supplied to private consumers was 99,027,126 cubic feet, for gas-motors 15,892,780 feet, and for street lighting 7,087,613 feet—making a total sale of 122,007,519 cubic feet. The amount of gas used on the works and unaccounted for was 22,481,581 cubic feet. Of coke there was 9609 tons produced, and of tar 135,044 gallons. There are 177 miles of mains, which supply 10,533 consumers, 242 gas-engines (1234 brake horse power), and 1130 street-lamps. The authorized capital of the undertaking is *yen* 2,100,000; and of this amount *yen* 1,890,000 has been paid up by the 454 shareholders among whom the 42,000 shares are divided. The capital value of the works and plant is *yen* 1.065,339; and the reserve funds amount to *yen* 200,000. The gross profit realized in the period referred to was *yen* 188,793.

* The Japanese yen is about equivalent to the U.S.A. dollar—say *yen* 5 = £1.

DISTRESSING CASE OF GAS POISONING AT TOTTENHAM.

A case of gas poisoning involving a whole family, and resulting in the death of father and son, occurred at Tottenham during the past week. The deceased are Mr. John Sanders, a house decorator, of 34, Markfield Road, Tottenham, and his youngest son Arthur. The full circumstances surrounding the lamentable occurrence were no doubt revealed at the inquest last evening; but in the meantime inquiries have disclosed the following particulars: Mr. Sanders, his wife, and two sons, had lived in the house for upwards of four years, and were supplied with gas, through a shilling-in-the-slot meter, by the Tottenham and Edmonton Gas Company. Last Tuesday the old meter was removed on account, it is stated, of faulty registration, and a new one was fixed. A shilling's worth of gas represents 270 cubic feet, which would be exhausted by the constant use of one burner in about 54 hours. In the house, however, were four burners and a gas-ring, though to what extent these were in regular use, the survivors—Mrs. Sanders and her elder son—had not, at the time of writing, sufficiently recovered from their more or less dazed condition to be able to state with anything like reliability. Nothing amiss appears to have been noticed until Thursday, when a Mr. Clarke called several times during the day; and being unable to make anyone hear by ordinary means, he finally knocked very loudly, with the result, as he says, that the elder son (John) came and opened the door in a dazed condition, and asked for a doctor to be called. Dr. Edward Hutton was immediately fetched; and John was then found unconscious at the foot of the stairs, while a strong smell of gas was permeating the house. Further investigation discovered the father lying in his bedroom on the floor dead, Mrs. Sanders in bed in the same room unconscious, and, in another room, the younger son dead in bed. It is said that a glimmer of gas was burning in the front room where Mr. and Mrs. Sanders were, and that the means of ventilation had been very considerably lessened by the blocking up of the chimney in one room with a bag of shavings, and the register in the other was let down. Our last information stated that the mother and son were making good progress towards recovery.

THE LEAMINGTON GAS-WORKS PURCHASE QUESTION.

The Position of the Corporation Defined.

The difficulty over the gas-works transfer question at Leamington, raised by the Corporation desiring to withdraw their notice to purchase, is not yet, judging from published information, any nearer settlement; but the Corporation have had their position clearly defined, and that is a step in the right direction. In a letter dated July 25 last, the Solicitor to the Gas Company (Mr. J. W. Hassall) writes to the Town Clerk in these terms: "The proposal made by you, for the Company to release the Corporation from the notice to purchase the gas-works, came before the Directors at their meeting yesterday; and it was fully discussed. It is, however, too clear for argument that the sale and purchase is a statutory obligation, which nothing but another Act of Parliament could release the parties from, and to this the Directors feel they cannot assent. They do not, however, wish to hurry the Corporation in the matter, and have postponed the appointment of an Arbitrator until their next meeting, which will be held the last week in August." Writing from the office of the Association of Municipal Corporations, Messrs. Sharpe, Parker, and Co. thus advise the Town Clerk: "Your Council cannot withdraw their notice to treat without the concurrence of the Company. They need not, however, proceed under their notice, unless they are compelled to do so by the Company obtaining a *mandamus* against them." These communications were included in the report which the General Purposes Committee submitted at the meeting of the Leamington Town Council yesterday week; but Alderman Wackrill mentioned that they would be unable to take any action on that occasion. A special meeting was called for yesterday to further consider the letters, and it was expected a report would then be made upon them.

THE COST OF REMOVING GAS-LAMP COLUMNS FROM STREETS LIGHTED BY ELECTRICITY.

An interesting controversy is proceeding at Windsor regarding the question whether the Town Council can compel the Gas Company to remove the gas-lamp standards from streets which are now being lighted by electricity. The cost of doing this, which is the main factor in the dispute, is variously estimated at from £250 to £300. A Committee of the Council have met a Committee of the Company's Directors, and talked over the matter; and, in practically identical terms, cases have been laid before Mr. Macmorran, Q.C., on behalf of the Council, and before Mr. Shiress Will, Q.C., and Mr. Danckwerts, Q.C, for the Company. Mr. Macmorran is of opinion that the Council can compel the Company to remove the columns; while Mr. Shiress Will and Mr. Danckwerts are equally confident that they cannot. Under the circumstances, the Council are in a quandary; and the best course to take is not altogether clear to them. Various suggestions have been made to get the issue definitely determined. One is that the matter should be jointly submitted to another Counsel, whose opinion should be final and binding. A second proposition is that a special case should be stated for the decision of the Queen's Bench Division of the High Court of Justice. Neither proposal has yet been adopted. During the discussion of the matter, it has transpired that lamp standards in Eton have been removed at the request of the District Council, and that the Council have paid the Company for the cost of removal £1 in the case of standards and 10s. in the case of brackets. Upon these terms, the Company are willing to remove all or any of the lamp-standards in Windsor; the Council to bear the expense of reinstating, if required. The Council, however, will not agree. The end of a discussion on the matter at their last meeting was that the question was referred to a Special Committee, consisting of members not interested in either Company.

CARLISLE CORPORATION GAS AND WATER UNDERTAKINGS.

Gas-Works Extensions and the Annual Report.

The minutes presented by the Gas and Water Committee at last Tuesday's meeting of the Carlisle City Council contained the information that Mr. Corbet Woodall had met the Committee and discussed with them the question of the extension of the gas-works so as to meet the increasing demands of the city either by (1) the development of the existing works; (2) extension at Boustead's Grassing; or (3) the erection of a carburetted water-gas plant. He had promised to submit his report upon the existing works, and the best means to be adopted for increasing the quantity of gas made, as early as possible. The annual report and accounts, from which we gave particulars last week, were also submitted.

Mr. Corbett, in moving the adoption of the report, said that the gross gas profits showed a falling off to the extent of £2600 as compared with last year, although the consumption of gas had increased about 2 per cent. The gross gas profits came to £7090, as against £8760 last year. This was almost entirely due to the increase in the cost of coal. The net profit, after paying interest and meeting the redemption of loans, was £4513, as against £6713 last year; being £2200 less. The residuals were much better than they were last year. The number of consumers had increased by 574; and there were now about 6474 ordinary meters,

and 3250 slot meters. The abolition of meter-rents had reduced the revenue from this source to £450 this year; and next year there would be no revenue from meter-rents at all. With regard to the net profits of £4513, the Committee felt, and he hoped they would approve of the course, that the sum should be left in their hands, in order to meet the heavy strain which would be brought upon the finances in the current year owing to the great increase in the cost of coal—about 50 per cent. If the sum were not left in the hands of the Committee, there would be a great deficit at the end of the year; and this deficit would have to be made good by the Council, or the price of gas would have to be raised. On the other hand, if the Council left it at the disposal of the Committee, the income and expenditure next year would probably about balance each other; at least, he hoped any deficiency there might be would not be much. The water accounts showed a gross profit of £5783; and after paying interest and redemption of loans, a net profit of £4461 was available for the district fund—about £300 less than last year, owing mainly to the increased cost of fuel and extra repairs, and also the cost of a new pump which had been put in.

Mr. COULTHARD, in seconding the motion, said the accounts were not quite so satisfactory as they had been in some past years; but still, when they took everything into consideration, the gas and water works had proved a great boon to the city. In looking over the figures, it would be seen that the net profit from the gas-works the past five years had been £27,851, and from the water-works during the same time £19,284—making a total of £47,035, or an average of nearly £9500 a year, which at the present rateable value represented about 1s. 1d. in the pound. He hoped by the end of next year coal would be reduced in price, and they would again return to prosperity.

The motion was agreed to.

Mr. CORBETT, replying to a question later in the proceedings, stated that the amount expended in investigating the River Gelt and other probable sources of water supply from the year 1895 until parliamentary proceedings had been about £600. This amount had been expended with the sanction of the Water Committee, who had directed the investigation to be made, and had been charged to the revenue account of the department in the years in which it was expended.

NOTTINGHAM CORPORATION GAS SUPPLY.

The Results of the Year's Trading.

In presenting their report to the Nottingham City Council for the twelve months ended March 31, the Gas Committee point out that, though the weather during that time was not at all severe, the consumption of gas increased enormously; the excess of output over the previous year being no less than 125 million cubic feet. This is the highest increase which has ever taken place in any year during the existence of the undertaking. The total quantity of gas sold was 1,742,154,300 cubic feet, as compared with 1,617,055,700 cubic feet the previous year. The Committee had to pay £17,256 more for coal than in the previous year; but fortunately this was more than recouped by the higher prices received for residuals. The coal contracts have since been let at varying increases up to 5s. per ton advance on last year's prices; and as the top of the market had already been reached in residuals, the Committee have been reluctantly compelled to raise the price of gas by 4d. per 1000 cubic feet, to cover the increased cost of coal. The amount realized from the sale of gas last year was £209,317, compared with £194,489 received, being an increase of £14,828. The sum of £2260, withdrawn from the Giltbrook depreciation fund in 1898-99, for the purpose of renewals, has now been refunded; and £1000 has been written off capital for depreciation of stoves, as compared with £500 the previous year. The net profit for the twelve months was £26,038. Of this sum £24,000 will be paid to the Finance Committee (by order of the Council) in aid of the expenditure of the municipal year; and the balance will be carried to the annuity redemption fund.

Appended to the Committee's report was one by Mr. W. R. Chester, M.Inst.C.E., the Engineer and General Manager, on the works and manufacturing operations during the year to March. It states that the plant, machinery, and buildings at the various works have been kept in good repair throughout the year.

The work in connection with the conversion of retorts in No. 2 retort-house at Eastcroft (commenced last year) has now been completed, and the apparatus put into successful operation. The installation includes the conversion of sixteen beds of horizontal retorts, which were formerly worked by hand, into a like number of beds of inclined retorts wholly worked by mechanical power. This is the most complete installation in existence, and the first in which the whole process of carbonizing is done by mechanical means from the point where the coal enters the works in trucks until the coke is loaded into trucks ready to leave again, sorted, sized, and in good marketable condition. The retort-settings, which were formerly heated by two furnaces to each, will now be heated by one only; and it is expected this will result in a considerable saving in fuel.

At Basford works the output of gas has already overtaken the capacity of the existing plant and machinery, most of which has been taxed to the utmost limit during the past winter. Before any increased output of gas can take place, it will be necessary to make some rather extensive additions to, and enlargements of, apparatus at these works. The foundations for a third section of retorts in the new retort-house are already being put down; and contracts have been let for two additional steam-boilers. These must be followed by an enlargement of purifiers, exhausters, condensers, and station meters, and, finally, by additions to the gas-holder storage capacity.

At the Radford works gas making has been discontinued during the summer months on account of the high cost of production at these works compared with Eastcroft and Basford, where the apparatus is so much more modern and efficient. The works will be put into operation again in the early winter.

The renewals and enlargements of the acid and ammonia plant at the Giltbrook chemical works, which were commenced last summer, have all been completed; and with one or two exceptions these works are in a high state of efficiency. Additional boiler-power is needed, and also a duplicate saturator for the ammonia plant.

The alteration to the tramway lines has necessitated some extensive alterations to the gas-mains along the respective routes; and these are now being carried out.

The average illuminating power of the gas for the past year has been 18·72 candles; and the sulphur compounds have been kept down to 27·49 grains of sulphur per 100 cubic feet of gas.

The total mileage of mains is 306·83; there having been 5·32 miles added to the canalization during the year. The number fixed to March 31 (including 364 lamp-meters), was 46,551; being an increase of 1887 meters on the previous year. Of these, 43,895 belong to the gas department, and 2656 to the consumers. The demand continues for prepayment or "penny-in-the-slot" meters. At the end of the financial year 8034 of these meters were in operation, an increase of 1487 on the previous year. The application of gas for trade and domestic purposes, other than lighting, continues to increase. There are at present in use about 6935 gas cooking stoves, 7011 gas-fires, and 452 gas-engines, besides a large number of other appliances of almost every description, which have not been numbered. Of the 6935 cookers in use, 5654 are rented from the department, and 935 supplied with automatic meters rent free.

Analysis of the Accounts for the Years ending March 31, 1899, *and* 1900.

—	1899.	1900.
Coals carbonized tons	167,011	184,487
Gas made cubic feet	1,715,760,000	1,853,377,000
,, sold ,,	1,617,055,700	1,742,154,300
,, unaccounted for ,,	98,704,300	111,222,700
,, ,, per cent.	5·75	6·00

—	1899. Amount.	1899. Per Ton of Coals.	1900. Amount.	1900. Per Ton of Coals.
EXPENDITURE.	£	s. d.	£	s. d.
Manufacture—				
Coals	78,329	9 4·56	95,585	10 4·35
Purification	5,346	0 7·68	6,630	0 8·63
Salaries	1,916	0 2·76	1,946	0 2·53
Wages for carbonizing	22,190	2 7·89	24,855	2 8·33
Repairs and maintenance	27,822	3 3 98	37,632	4 0 96
Distribution—				
Salaries and wages	6,228	0 8·95	6,280	0 8·17
Repairs, &c., mains and services	9,266	1 1·32	10,178	1 1 24
Repairs, &c., meters	5,637	0 8 10	5,219	0 6·79
Repairs, &c, stoves	3,732	0 5 36	4,843	0 6·30
Lamp Fittings—	23	0 0·03	233	0 0 30
Rents, Rates, and Taxes—				
Rents and acknowledgments	526	0 0 76	521	0 0·68
Rates and taxes	10,475	1 3·05	10,657	1 1·86
Management—				
Salaries	3,168	0 4 55	3,236	0 4·21
Collectors	2,252	0 3·24	2,337	0 3·04
Stationery, printing, &c.	795	0 1·14	830	0 1 08
General establishment charges	483	0 0·69	521	0 0·68
Auditors	110	0 0 16	110	0 0·14
Law Charges—	21	0 0 03	48	0 0 06
Bad Debts—	401	0 0·58	354	0 0·46
Total expenditure	178,720	21 4 83	212,015	22 11·81
RECEIPTS.				
Sale of Gas—				
Private consumption	184,776	22 1·53	199,174	21 7·11
Public lights	9,713	1 1 96	10,143	1 1·19
Rental of meters	6,313	0 9·07	6,405	0 8·33
,, stoves	2,137	0 3 07	2,383	0 3·10
Residual Products—				
Coke and breeze	24,109	2 10 64	32,133	3 5 80
Tar and its products	12,807	1 6·40	17,946	1 11·35
Sulphate of ammonia	7,192	0 10·34	15,182	1 7 75
Refuse lime, &c.	917	0 1·32	1,051	0 1 37
Distribution materials (meters and services)	2,672	0 3 84	3,059	0 3·98
Stoves, gas-fires, &c	960	0 1·38	1,258	0 1 64
Rents	461	0 0·66	508	0 0·66
Sundries	34	0 0·05	89	0 0·11
Annuities	31	0 0 05	31	0 0·04
Total receipts	252,122	30 2·31	289,362	31 4·43

At the Monthly Meeting of the Nottingham City Council yesterday week, Alderman Barber moved the adoption of the Gas Committee's report—a motion that was seconded by Alderman Truman, and carried without discussion.

DANGEROUS GAS PENDANTS.

[From the "Lancet."]

If we do not go so far as to say that the "gas chandelier," or water-slide pendant as it is called, should be made illegal, we certainly think no prudent householder should put one of them into his house. It is never at any time, by any twist of the imagination, ornamental; it frequently occasions alarm; and in not a few instances it has been the cause of death. As everyone knows, the principle of this "chandelier" is that of a water-seal, which, of course, fails when there is no water in it. Few people remember to replace the water, which easily evaporates in a warm atmosphere. Even supposing, however, that there is water in the sliding-tube, the chains supporting the weights which keep the pendant in position may easily get defective; and thus the bracket may drop below the water-seal, and the gas be allowed to escape. This is probably what happened in the melancholy occurrence reported from Birmingham last week [see *ante*, p. 660]. It was shown that a water-slide pendant had become defective owing, not to want of water in the tube, but to the flimsy chain fittings. These defects accounted for the

death of a man, and very nearly that of his wife. Both had retired to bed in good health; but before the morning they were poisoned with the escaping coal gas, which doubtless they had inhaled during most of the night. We have before recorded cases of this sort; and surely it is time that this clumsy contrivance known as the "chandelier" should be banished. It is a most dangerous fitting, and quite unnecessary in view of the improved modern appliances which are now made for conveying gas from the supply-pipes to the burner. A good deal has been said of late against the increasing practice of carburetting gas—a method which raises the proportion of carbon monoxide very considerably in illuminating gas. It is said that gas of satisfactory illuminating value could not be supplied without recourse to this plan; for not only are all kinds of coal more expensive than formerly, but the supply of the more bituminous varieties is distinctly running short. It must be remembered that coal gas is poisonous under any circumstances; and, that being so, care must be enjoined in its use. But the fact that our present supply of coal gas does contain much more carbon monoxide than was hitherto the case, warrants more forcibly our argument in favour of the abandonment of the "chandelier."

GAS EXHIBITION AT MANCHESTER.

An interesting Gas, Industrial, and General Illuminating Exhibition was opened on Monday last week at St. James's Hall, Manchester. The General Manager of the undertaking is Mr. Thomas G. S. Hersey, who was the organizer of a similar exhibition held at the Royal Aquarium, Westminster, last winter; and most of the firms who exhibited on that occasion are again represented by specimens of their productions. The inaugural proceedings, a full account of which appears below, presented a somewhat novel feature in the fact that, while the Chairman of the Manchester Corporation Gas Committee (Alderman Gibson) performed the opening ceremony, the head of the Electricity Committee (Alderman Higginbottom) occupied the chair; and further proof of the active interest taken by the Manchester Corporation in the enterprise is furnished, at one of the stands, in a special exhibit which has been prepared by Mr. J. G. Newbigging, the Engineer to the Gas Department, to illustrate the methods whereby gas can be tested and analyzed. The exhibits are divided into a number of classes, including gas cooking and heating apparatus, gas lighting, gas plant, gas plant photos and models, acetylene gas apparatus, samples of bye-products, gas coal and cannel coal, and the testing and analytical appliances already mentioned. In addition to the exhibits at the various stands, the Manager has arranged for a series of cookery lectures to be delivered by Miss Sylvester, the Principal of the Leamington School of Cookery; and the Band of H.M.'s Royal Horse Guards (Blues), under the conductorship of Lieutenant Charles Godfrey, is engaged, by permission of Colonel Lord Binney, to give musical selections daily. The exhibition will close in Manchester on Sept. 29, and will be continued in Bristol in November next.

In the gas cooking and heating section, one of the most prominent displays is that of Messrs. Fletcher, Russell, and Co., who show a large selection of their new and standard designs in heating and cooking appliances, comprising combined gas and coal kitchen ranges, close-fire ranges, coke grills, mantelpieces, overmantels, copper and brass interiors, with tiled panels, gas-fires in Victoria bronze, nickel, and gold finishes, gas cooking-ranges, carving tables with overhead dish-covers, gas-governors, gas soup-boilers, gas greenhouse boilers, gas stockpot stands, and gas water-heaters. Messrs. S. Clark and Co. have a good display of their patent "Syphon" stoves, which dispense with the necessity for a flue, and, it is claimed, produce the heat of a coal-fire at the cost of 1d. for three hours' burning. At the stand occupied by Messrs. Richmond and Co. is to be seen a varied group of this well-known firm's specialities in gas heating and cooking apparatus, including both designs which are already secure in popular favour and new ones for the coming season. It may be mentioned that the firm are just now introducing, in connection with their slot cookers, a new detachable gas-bar, which enables the taps to be readily taken out for cleaning or other purposes; and a further novelty is an improved attachment to prevent lighting-back where water gas is used in connection with gas-fires. The firm have also opened a special department at Warrington, for large cookers, for hotels and institutions, adapted for either steam or gas. The Davis Gas-Stove Company draw attention to their Manchester Metropolitan "L.B." cookers; and the Manchester Gas-Cooker, Limited, show the patent "Hygienic" gas cooking-range. The Cannon Hollow-Ware Company's exhibit includes all their latest improvements and designs in gas-cookers, grillers, &c.; and in connection with the "Chef" and "Hercules" cookers, special stress is laid on the fact that they are fitted with the "Porceliron" oven linings and crown plates, which, it is claimed, are practically indestructible. Messrs. Wilsons and Mathiesons have a griller, in which the radiating plate is constructed with two separate supplies of gas, one to each side of the burner, so that either half can be used independently.

At the stand of the Matchless Gas Lighting Syndicate are shown the latest improvements in their self-lighting apparatus. The ignition agent in this self-lighter has recently been greatly improved; and it is stated that it will now remain active for two to three years without attention, instead of about twelve months as previously. The mechanism has also been greatly simplified by the adoption of a specially constructed two-way tap. When this is turned full on, the gas is switched to the ignition-jet. The tap is then turned half-way back, which switches out the ignition-jet, and lights the burner. In addition to ordinary and incandescent indoor lights, the Company show a street lantern worked on the same principle. In this arrangement, the lamp-lighter has simply to push up a lever as far as it will go, and wait for the ignition-jet to light by the action of the igniting agent. This jet is placed close to the mantle; but the lever which actuates it is underneath, and outside the lantern. The advantage secured is that all the mechanism is outside, and there is no necessity to put any torch or lighting arrangement into the lantern itself. In conjunction with Messrs. Richmond, the Company are showing their self-lighter as applied to gas-fires, in which a small tap is used for lighting the ignition-jet, and a larger one for turning on the main supply to the stove. The Company are also introducing an adjustable nozzle for Welsbach "C" burners, whereby the pressure of gas can be regulated so as to secure the greatest possible effective lighting power in the mantle. An interesting novelty among the exhibits of the London and Manchester Sanitary Patents Company is a new patent connection for gas and other pipes, by which washers and soldering are dispensed with. In this arrangement, the pipe goes inside the ferrule or tail-piece, instead of outside, and is turned over on the flange of the ferrule, making its own joint, after which the ordinary nut is placed over it. The pipe can be bent close to the connection, without fear of its breaking the joint, and can be disconnected and re-connected as frequently as desired without using a washer. The Incandescent Novelties Company are giving daily exhibitions of the process of mantle-making.

Perhaps the most interesting portion of the exhibition from a scientific point of view is the stand occupied by Messrs. Alexander Wright and Co., who show a large selection of their well-known photometrical, testing, and laboratory appliances. Their exhibits include several varieties of standard photometers; a speciality being one with incorrodible porcelain meter, King's gauge, and governor. A rapid-reading photometer for use with water gas, which has previously been described in the "Journal," is also shown; while a Harcourt's table photometer, as specified for use in London, is another feature. There are exhibited several standards of light, including the Methven screen, Simmance's pentane standard, &c., with methods of instantly connecting these to the photometer. Among other apparatus on view are chemical benches specially designed for use in gas-works, chemical balances, sulphur and ammonia testing apparatus, experimental minute clocks, chemical apparatus and solutions, and pressure gauges and registers. Simmance and Abady's calorimeter is exhibited, showing the special arrangement for fitting to exising photometers, so as to avoid expense in connection with auxiliary apparatus, such as experimental meters, &c. Street-lamp governors for ordinary and incandescent burners are also on view. A special feature of the exhibit is a dark room in which is working a Harcourt photometer, arranged for testing gas from 14 to 24 candle power, as used by the Manchester Corporation, and which has attracted a good deal of attention. This portion of the stand has been arranged by Mr. J. G. Newbigging, Gas Engineer to the Corporation, who has also prepared an interesting exhibit of other apparatus used by the Corporation, most of which is of Messrs. Wright's manufacture, including porcelain jet photometers, sulphur-testing appliances, &c. In addition to these, Mr. Newbigging has arranged an excellent display of purifying materials, bye-products of oxide and of tar, &c. Public interest was specially attracted by an exhibit showing Simmance and Abady's patent momentary pilot system, which was described in the "Journal" for Oct. 10 and May 1 last.

The Acetylene Illuminating Company show a number of photos of works engaged in the production of carbide. Messrs. S. Cutler and Sons have sent a number of interesting photos of work which they have carried out in connection with gasholders in various parts of the kingdom. The official illuminators, stand fitters, sign-writers, and decorators to the exhibition are the firm of Defries and Son, who make a good display of their cut crystal illuminations, and also exhibit the Defries and Feeny patent differential gas-regulator, which has previously been referred to in these columns.

At the opening proceedings, Alderman Higginbottom (Chairman of the Manchester Corporation Electricity Committee) occupied the chair; and he was supported by Alderman Gibson (Chairman of the Gas Committee), Alderman Rudman (Mayor of Salford). Sir W. H. Bailey, Mr. C. Nickson (Superintendent of the Manchester Corporation Gas Department), Mr. Price (Assistant-Superintendent), Mr. J. G. Newbigging (Gas Engineer to the Corporation), Councillors Phythian, Fildes, Marsden, Harrop, and Hassall, and Mr. Hersey (the Manager of the Exhibition).

The Chairman observed that his duty on this occasion was a very simple one. The whole of the work devolved on the gentleman who had to declare the exhibition open. He himself, however, was particularly pleased to be there, because he held the position of Chairman of the Electricity Committee, who were supposed to be rivals of the gas undertaking, and running it very hard indeed. He wanted to disabuse the minds of people who held the view that the Electricity Committee were inimical to the gas undertaking. When first electricity was taken up in Manchester, there was a feeling among many people that the Gas Committee and undertaking would in a few years be defunct. He himself had not held this opinion, nor had the Chairman of the Gas Committee. The actual result was—not only in Manchester, but in every other leading city in the United Kingdom—that wherever electricity had flourished and made rapid strides, the gas undertaking had made quite as great, if not greater, progress. To-day they saw the beginning of what was to be a good exhibition; and he hoped the public would take advantage of it. They would have an opportunity of getting a good deal of information respecting everything which tended and appertained to the working of the gas industry, and the relation of the gas industry to themselves. They would be able to learn, if they liked to take the trouble, how they could have gas tested, in order to see that they got what they paid for. The promoters had taken a great deal of pains to prepare a good exhibition; and he trusted the public would give it their support.

Alderman Gibson said he thought Mr. Hersey was to be congratulated in securing the presence of the Lord Mayor Elect, who was Chairman of the Electricity Committee. It certainly seemed somewhat unique to find the Chairman of the Electricity Committee and the Chairman of the Gas Committee of the same town, standing on the same platform, one taking the chair and the other opening an exhibition connected purely with the gas industry. He hoped that both Alderman Higginbottom and himself would in the future, as they had done in the past, do the best they could to develop the particular undertakings with which they were connected. The exhibition was not yet in a complete state; but from what he had already seen, he ventured to say that in another three or four days it would be a very excellent show. In looking at the various exhibits, he could not help wondering what would have been said by Murdoch, the discoverer and original introducer of gas as a source of lighting, if he had been living and present on this occasion. Perhaps they would be interested to learn that Manchester was the first town that ever secured an Act of Parliament enabling them to supply gas to private houses for illuminating purposes. The first public lamp that was ever seen was in Manchester. It was fixed over the door of the old Police Station, in Police Street, and was a source of great amazement to many people, who

came from long distances to see it, but when in its vicinity gave it a wide berth for fear it might explode or burst. Gas was then extended to the lighting up of the then Commissioners' offices; and this was followed by the starting of a considerable number of lamps in the public streets. As its superiority to other lights became so conspicuous, the public grew anxious to obtain gas for private consumption; and he thought the year 1817 might be taken as that from which anything like a gas establishment could date. The price of gas at that time was 14s. per 1000 cubic feet. From 1817 to 1824, the demand had increased so rapidly that in the latter year there were 7 miles of pipes laid in the town; to-day they had 802 miles. The gross cost of the works in 1824 was £40,937; to-day the gas-works of the city had cost over £3,000,000. The net profit on the undertaking in 1824 was £3774; last year it was £73,964—and not at 14s., but at 2s. 3d. per 1000 cubic feet. On every occasion when gas had been reduced in price, the consumption had enormously increased. Notwithstanding the electric light in Manchester—the progress of which had reflected credit on all who had been connected with it—the gas undertaking had continued its growth; and last year the consumption of gas was 268,770,000 cubic feet in excess of the previous year, and, of course, greatly in excess of any previous record. He might, however, remind them that the path of the Gas Committee was not altogether strewn with roses; there were always some grumblers and complainers. Some people actually complained of the amount of their bills; but he feared many needed to study the question of economy in the use of gas. There was an impression in some quarters that the more gas they burnt the greater light they would get; but, in his judgment, the amount of gas they burnt was not necessarily a criterion of the quantity of light they obtained. They would, however, see at the exhibition a number of gas-saving appliances which, if taken advantage of by the public, might lead to a considerable saving in their bills. He would also like to say a word or two to any gas managers and engineeers who might be present. The Chairman had thrown down the gauntlet of electricity. It was for gas engineers and experts to take it up—to keep themselves well abreast of the times and all modern improvements and inventions, so that they might not be caught tripping by any ambitious competitor. He had much pleasure in declaring it open.

Sir W. H. Bailey, in moving a vote of thanks to Alderman Gibson for the able manner in which he had opened the exhibition, said they all admired that gentleman, and knew that his Committee was a triumph of municipal government. It seemed very proper that the exhibition should be held in the Metropolis of Gas Engineering. Manchester and Salford were the first two towns in which the ratepayers owned the gas-works. The Commissioners did establish a gas-works in 1817, under the auspices of Murdoch; but before that, by two or three years, the first cotton mill in Lancashire was established in Salford—Phillips and Lees, in Chapel Street—and gas was used there. He had seen tubes from this mill; and it was interesting to note that neither lead nor iron was used. The tubes were formed of brown paper glued together. Manchester was now making great progress in its gas undertaking; and whatever might be the opinion of those who used electricity or gas as to their relative efficiencies, they knew very well that the introduction of electricity had tended to bring about a considerable improvement in connection with the use of gas throughout the country. They had better burners, and better methods generally of using gas; and more attention was paid to its purification. He had nearly omitted to mention that the gas-meter was invented in Manchester by Richard Roberts. Most books on the subject said that Clegg, of Oldham, invented the gas-meter; but this was quite a mistake. A deputation of the Commissioners of Manchester and Salford waited on Richard Roberts (who was then in a small way of business in Newmarket Buildings), and requested him to invent a method of measuring gas, in order that the Commissioners might charge a proper amount to those who bought it retail. Roberts did invent a gas-meter, which was very successful. Immediately afterwards, Clegg also invented another meter. Probably he might have worked it out simultaneously; but, at any rate, the gas-meter used by the Commissioners was invented in Manchester by Richard Roberts. Gas was now being employed more than ever. In Belgium, gas-engines were being used of from 500 to 1000 horse power, in various steel and iron works; and a very large works was being erected on the Trafford Estate (Manchester) for the manufacture of gas-engines. It was just possible the steam-boiler might be doomed, and that the gas-engine of the future would supplant the steam-engine. In conclusion, Sir W. Bailey paid a tribute to the work done for the citizens of Manchester by Alderman Gibson as Chairman of the Gas Committee. The art of appreciation was not cultivated sufficiently with respect to those who devoted their time to the public service; while, on the other hand, the art of indignation was somewhat over-cultivated. With all the occasional errors, from which no institution could be expected to be free, British municipal government was the purest in the world. And of this municipal government they had a very worthy representative in Alderman Gibson.

Alderman Gibson, in responding, observed that Alderman Higginbottom and himself had been on the Gas Committee for many years, and also on the Electric Light Committee; and there had been a time when they thought that the one undertaking might in some measure interfere with the prosperity of the other. But they had now come to think that the period would never arrive when the Electricity Committee would be anything but a help to the gas undertaking, and *vice versâ*.

Alderman Rudman, Mayor of Salford, moved a vote of thanks to Alderman Higginbottom for his services in the chair. When they saw that the Chairmen of the two Lighting Committees were working in such friendly rivalry, the ratepayers could rest assured they would get the best possible light, whether gas or electricity, at the lowest possible cost.

Alderman Higginbottom having briefly responded to the vote, the inaugural proceedings were brought to a close.

The Hastings and St. Leonards Gas Company have received a word of praise from the "Hastings Observer" for the tasteful manner in which they carried out part of the illuminations at a recent Rifle Band Fête in the Alexandra Park. The gateways and the band stand, it is stated, were brilliantly adorned with gas-lights, and here and there within the Park were beautiful incandescent gas-lamps.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 690.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**			£ s. d.	£			p. c.	**GAS COMPANIES.**			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	18½—19½	..	5 7 8	60,000	5	Feb. 23	7	Ottoman, Ltd. . . .	5—5½	..	6 7 3
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5	500,000	100	June 1	6	People's Gas } 2nd Mtg. of Chicago } Bonds .	102—106	..	5 13 2
800,000	100	July 2	5	Australian 5 p. c. Deb. .	101—103	..	4 17 1								
200,000	5	May 16	6	Bombay, Ltd. . . .	6—6½	..	4 12 4	851,070	10	Apl. 27	7	River Plate Ord. . . .	10½—11	..	6 7 3
40,000	5	,,	6	Do. New, £4 paid .	4—4½	..	5 6 8	250,000	Stk.	June 28	4	Do. 4 p. c. Deb. .	99—101	..	3 19 8
880,000	Stk.	Aug. 15	12	Brentford Consolidated	245—255	..	4 14 1	250,000	10	Apl. 11	8	San Paulo, Ltd. . . .	11½—12½	..	6 8 0
270,000	,,	,,	9	Do. New . . .	177—182	..	4 18 11	135,000	Stk.	—	10	Sheffield A.	—	..	—
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0	209,730	,,	—	10	Do. B.	—	..	—
159,375	,,	June 14	4	Do. 4 p. c. Deb. .	116—120	..	3 6 8	447,427	,,	—	10	Do. C.	—	..	—
220,000	Stk.	Sept. 14	10	Brighton & Hove Orig. .	220—230*	..	4 6 11	5,641,885	Stk.	Aug. 15	5½	South Metrop., 4 p.c. Ord.	127—129	..	4 2 7
226,330	,,	,,	7	Do. A. Ord. Stk. .	150—160*	−1½	4 7 6	1,520,000	,,	July 12	3	Do. 3 p. c. Deb. . .	94—97	..	3 1 10
1,009,500	Stk.	Aug. 29	5	Bristol, 5 p. c. max. .	117—118	..	4 4 9	380,940	Stk.	May 16	5	Southampton Ord. . .	115—120	..	4 3 4
420,000	20	Mar. 29	10	British	40—42	+1	4 15 3	70,825	,,	July 12	4	Do. 4 p.c. Deb.	117—122	..	3 5 7
50,000	10	Aug. 15	12	Bromley, Ord. 10 p. c. .	24—26	..	4 12 4	120,000	Stk.	Aug. 30	6	Tottenham } A. 5 p.c. and } B. 3½ p.c.	80—85	..	5 5 11
79,000	10	,,	9	Do. 7 p. c. . . .	19—21	..	4 5 8	250,520	,,	,,	4½				
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	8½—9½	..	6 9 9	61,550	,,	June 14	4	Edmonton } 4 p. c. Deb.	111—115	..	3 9 7
220,000	Stk.	June 14	4	Do. 4 p. c. Deb. .	98—100	..	4 0 0	182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
150,000	20	July 12	8½	Cagliari, Ltd. . . .	23—25	..	6 12 0	149,900	10	July 2	5	Do. 5 p. c. Deb. Red.	98—102	..	4 18 0
100,000	10	June 14	8	Cape Town & Dis., Ltd.	13½—14½	+½	5 10 4								
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	54—56	−1	5 7 2								
550,000	Stk.	Apl. 11	13½	Commercial Old Stock .	270—280	..	4 16 5								
286,425	,,	,,	10½	Do. New do. .	205—215	..	4 17 8								
288,237	,,	June 14	4½	Do. 4½ p. c. Deb. .	133—138	..	3 5 8								
800,000	Stk.	May 31	9	Continental Union, Ltd.	160—165	..	5 9 1								
200,000	,,	,,	7	Do. 7 p. c. Pref. .	170—175	..	4 0 0					**WATER COMPANIES.**			
51,600	Stk.	—	14	Croydon A 10 p. c. . .	—	..	—	780,404	Stk.	June 28	11	Chelsea, Ord.	298—303	..	3 12 7
178,400	,,	—	11	Do. B 7 p. c. . .	—	..	—	150,000	,,	,,	5	Do. 5 p. c. Pref. .	155—160	..	3 2 6
555,000	Stk.	Aug. 15	5½	Crystal Palace Ord. 5 p. c.	112—117	+2	4 9 9	160,000	,,	,,	4½	Do. 4½ p. c. Pref. 75	143—148	..	3 0 10
60,000	,,	,,	5	Do. 5 p. c. Pref. .	130—135	..	3 14 1	175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
486,090	10	July 27	11	European, Ltd. . . .	19—20	..	5 10 0	1,720,560	Stk.	Apl. 11	7	East London, Ord. . .	192—197	..	3 11 1
354,060	10	,,	11	Do. £7 10s. paid .	14—15	..	5 10 0	654,740	,,	June 14	4½	Do. 4½ p. c. Deb. .	147—152	..	2 19 3
14,993,075	Stk.	Aug. 15	4⅝	Gas- } 4 p. c. Ord. . .	97—99	..	4 8 10	890,000	,,	,,	3	Do. 3 p. c. Deb. .	96—98	..	3 1 3
2,600,000	,,	,,	3½	light } 3½ p. c. max. .	92—94	..	3 14 6	700,000	50	June 14	7½	Grand } 10 p. c. max. .	107—110	..	3 8 2
3,799,735	,,	,,	4	and } 4 p. c. Con. Pref.	114—117	..	3 8 5	810,000	Stk.	Mar. 29	4	Junction } 4 p. c. Deb. .	130—135	..	2 19 3
3,993,975	,,	June 14	3	Coke } 3 p. c. Con. Deb.	93—95	..	3 8 2	708,000	Stk.	Aug. 30	14	Kent	295—305	+5	4 11 10
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4	160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
3,800,000	Stk.	May 16	10	Imperial Continental .	203—208	+1	4 16 2	1,043,800	100	June 28	10½	Lambeth, 10 p. c. max. .	284—289	+2	3 12 8
473,600	Stk.	Aug. 15	3½	Do. 3½ p. c. Deb. Red,	99—101	..	3 9 4	406,200	100	,,	8	Do. 7½ p. c. max. .	205—210	..	3 16 2
75,000	5	June 14	6	Malta & Medn., Ltd. .	4½—5	..	6 0 0	350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb. .	128—132	..	3 0 7
560,000	100	Apl. 2	5	Met. of } 5 p. c. Deb.	107—110	..	4 10 11	500,000	100	Aug. 15	14	New River, New Shares	410—415	..	3 7 6
950,000	100	,,	4½	Melbourne } 4½ p. c. Deb.	106—108	..	4 3 4	1,000,000	Stk.	July 27	4	Do. 4 p. c. Deb. .	128—133	..	3 0 2
541,920	20	May 31	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 8	902,300	Stk.	June 14	7½	South- } Ord. . . .	193—198	..	3 15 9
667,946	Stk.	Aug. 30	9½	Newc'tle & Gatesh'd Con.	210—215	..	4 6 1	126,500	100	,,	7½	wark } 7½ p. c. max. .	182—187	..	4 0 3
299,855	Stk.	June 28	8½	Do. 8½ p. c. Deb. .	104—107	..	3 5 5	489,200	Stk.	,,	5	and } 5 p. c. Pref.	155—160	..	3 2 6
150,000	5	May 16	8	Oriental, Ltd. . . .	7½—7¾	..	5 3 8	1,019,585	,,	Apl. 11	4	Vauxhall } 4 p. c. A Deb.	129—134	..	2 19 9
135,000	5	,,	8	Do. New, £4 10s. pd.	6—6½	..	5 10 10	1,155,066	Stk.	June 14	10	West Middlesex . . .	273—278	+1	3 11 11
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1¾	..	4 11 5	200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	140—145	..	3 2 1
					* Ex. div.			200,000	,,	Sept. 14	8	Do. 8 p. c. Deb. .	97—99*	..	3 0 7
													*Ex div.		

ELECTRIC LIGHTING NOTES.

The Cleethorpes District Council have resolved to take the necessary steps to purchase and extend the electric lighting plant to be erected by the Tramways Company; it being the purpose of the Council to light the town with electricity.

The report on the Hampstead Vestry's electrical undertaking just issued, states that the capital outlay since the commencement of the undertaking five years ago has been £162,212. The total receipts for the past twelve months amounted to £30,661—an increase of £6283 on the previous year. The "gross profit" amounted to £16,325, of which the repayment of principals of loans and interest absorbed £6619. The total "net profit" since the commencement of the undertaking is said to have been £20,586.

The scheme for electrically lighting the Victoria Embankment will probably be commenced, it is reported, about the beginning of November. Tenders have already been accepted for laying the mains; and the whole of the lamp standards have been purchased. The scheme is expected to be completed by the early summer of next year. A London news agency reporter has learnt that the total number of the lamps will be 144; and that they will be divided into nine electrical circuits. The lamp standards will be 24 feet in height; and the lamps will be suspended over the roadway from an extending arm.

The Dudley Gas Company have a very bitter enemy in Alderman Bagott. For many years past he has never seemed to lose an opportunity of directing attention to what he is pleased to consider their shortcomings, and has consistently tried to influence his fellow-members of the Corporation to attempt a purchase of the gas undertaking. Now he is embracing the chance he has of "advertising" the rival illuminant. At last Tuesday's meeting of the Town Council, alluding to the increase in the price of gas which would be charged for public lighting after the 29th inst., he remarked that for years the Corporation had been trying to purchase the gas-works; but on every occasion they had endeavoured to do so they had failed, owing to the price asked being so large. Before the conclusion of the present year, however, the inhabitants of the town would be able to choose between gas and electric light; and he "hoped that the burgesses would rally round the Council by taking the electric light and making the scheme a gigantic success."

The Corporation of Longton having made application to the Local Government Board for sanction to borrow £28,500 for purposes of electric lighting, and for approval of the use of certain lands situate at the Corporation gas-works as a site for a generating station, &c., Mr. H. P. Boulnois sat at the Town Hall last Wednesday to inquire into the application. It was explained by the Town Clerk that the amount named was required to provide the necessary generating station, mains, feeders, &c., for the supply of electrical energy throughout the borough. The Order authorizing the supply was obtained in 1899. Before then the Corporation had retained Mr. Robert Hammond; and it was upon his report and recommendations that they were now proceeding. The staple trade in the town was the manufacture of china and earthenware; and apart altogether from the question of lighting business premises and residences, there was another important question. Recently there had been considerable agitation with reference to lead-poisoning and poisoning in other forms by the dust emanating from various processes; and a great amount of motive power was required for driving fans and other mechanical appliances. The Corporation anticipated that the supply of electrical energy would be a very great factor with reference to this particular matter, and that manufacturers' requirements would call for a large supply. It was proposed to put in the low-pressure continuous system; and the formal approval of the Board of Trade had been received. There was no opposition to the application.

THE TEES VALLEY WATER BOARD.

Some Striking Figures.

Two large sheets of figures have been presented to the Tees Valley Water Board, showing the amounts the Corporations have paid in the maintenance of the water-works during the past twenty-two years. From these it would appear that the three Corporations have paid £1,196,866 in that period, of which £127,498 represents redemption of capital. After deducting the revenues of the Water Board divided between the three Corporations each year, it is to be seen that between them they have had to pay out of the rates £214,494, which, after deducting the above-mentioned £127,498, representing their share of capital invested, leaves £86,966 as the total loss on the working during the twenty-two years. To meet this excess of charge over revenue, and the redemption of the £127,498 capital, the Corporation have had to levy rates varying from 2s. in the pound in 1895, to 1·96d. in the pound last year, or an average levy in 22 years of 5·92d. in the pound per year. Middlesbrough's average contribution from the rates is 5·28d. in the pound per year over the same period; Thornaby's is 9·93d. in the pound per year during the last sixteen years. These figures will, if divided by 2½, give an idea of what the Corporation have actually lost so far. The assumption is that the revenue may soon exceed the annual charges, and thus repay the Corporation in time for what they have lost, and leave them in possession of the water-works, with a slowly decreasing capital debt. Stockton last year had to levy only a rate of 1·96d. in the pound; Middlesbrough 1·18d. in the pound; and Thornaby 5·13d. in the pound.

The returns serve (says the "Northern Echo") to remind ratepayers of the three boroughs what a huge business the undertaking is. It cost £846,000 to begin with, but above £1,000,000 has been spent since then in additional works, and over a million pounds have been paid in interest on the capital borrowed on the security of the revenue and the borough funds and rates. Only £127,498 of the nearly two million pounds sterling has been redeemed; so that the capital representing the water-works is still a stupendous amount. More capital outlay is to be undertaken in providing the Grassholme reservoir; and the £68,570 paid last year in interest alone will, in the course of another ten years, be appreciably increased. These figures give a very inadequate idea of what is at stake, and dependent upon not merely the continued but the increasing

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prosperity of the three Teesside towns. About three-fourths of the water supplied, it has to be remembered, is consumed by the "large consumers"—the iron manufacturers. Thus the water undertaking is very closely concerned with the growth of industrial activity on Teesside.

Mr. D. D. Wilson, the General Manager of the Board, has reported, in accordance with instructions, on certain resolutions passed at a town's meeting in Middlesbrough on July 27. These resolutions protested against the decision to let a contract of £385,000 for the Grassholme reservoir without obtaining tenders by open competition, especially after going to the expense of preparing bills of quantities. It was further considered that the advance of 10 per cent. on the present schedule of prices was excessive, as the value of labour and material would fluctuate during the ten years over which the contract would extend. Mr. Wilson replied that as only eight out of forty councillors signed the requisition, and 200 ratepayers out of 19,000 had attended the meeting, it was evident that only a small minority protested. The statement as to bills of quantities was not in accordance with facts. The Board had incurred no expense whatever in preparing them—they were prepared entirely at the expense of the Engineer, and before the Board had decided to either invite tenders or ask Mr. Scott to tender. The small increase of 10 per cent. upon the prices of eleven years ago was very much more favourable than might have been expected, judging from the experiences of other public bodies. Three tenders, Mr. Wilson added, were received in response to the advertisements, and Mr. Scott's—the one in question—was the lowest.

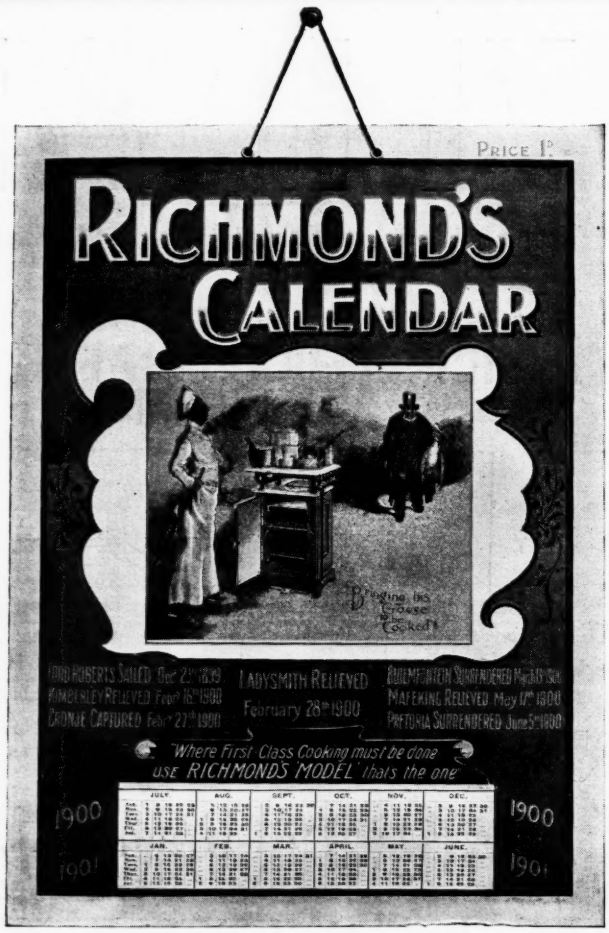
NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I was present this week at the meeting of the Waverley Association of Gas Managers, a report of which appears on another page. It was held under somewhat peculiar circumstances, for the President (Mr. W. M'Giffen), who, when he was elected at the meeting in Selkirk last April, was Manager at Earlston, in the valley of the Tweed, has since been translated to Huntly (in Aberdeenshire), to succeed the late Mr. Bowman; and his new location being a distant one, Mr. M'Giffen was unable to be present. The meeting having been called to order by the Hon. Secretary, the Past-President (Mr. W. B. M'Lusky), who has, since the April meeting, been transferred from Selkirk to Perth, not being in the room, the choice fell unanimously upon Mr. A. Bell, sen., the venerated Manager of the Dalkeith Gas Company. Mr. Bell is not only himself a host in all matters pertaining to gas making, but he has two sons gas managers, both already distinguished for intelligent enterprise—the one at Peebles, and the other at Innerleithen. No meeting held under Mr. Ball's chairmanship will ever flag; for his experience in gas matters has been so long, and in other respects so varied, that were no one else to speak, he could himself conduct the business profitably for an indefinite period. He is at home in chemistry and in geology, of which latter fact the members had ample evidence before the day was over, in his lucid descriptions, on the ground, of the Lothian coal-field and its workings. Dalkeith is a centre of the Waverley district which is easily reached; and the attendance was therefore excellent. Great pleasure was felt when, shortly after the proceedings were opened, Mr. M'Lusky arrived from Perth, thus showing his interest in his old Association. The members were also pleased to have among them Mr. Henry O'Connor, of Edinburgh, who, however, taking a back seat, missed the observation of the Chairman, and thereby led to a most powerful contribution to the day's discussion being almost lost. Though the President was absent in person, his mind was present in the most effective form in which intellect can be felt and handled—viz., in his thoughts delineated upon paper by means of the printing press. This Presidential Address was read. It was just what an address to the Waverley Association should always be—short, practical, and free from generalities. According to Mr. M'Lusky, the department in which Mr. M'Giffen is conspicuously successful is the retort-house; and it was therefore wisdom on his part to confine his remarks to difficulties which are encountered in retort-house working. Avoiding giving any expression of opinion upon plans or systems of constructing retort-benches, Mr. M'Giffen applied his mind to difficulties which are common to all methods—defects in setting, and the removal of the carbon which gathers in the retorts. These were both common ground to all gas managers, and were most eminently fitted for tapping the reservoirs of discussion—which they most effectively did. Everyone had some experience of his own upon one or other of the subjects; and the narration of these experiences was the most due fulfilment of the primary object of the Association, which is to give mutual help in matters of working. Thus a most profitable hour was spent; and Mr. M'Giffen ought to feel highly gratified at the success which attended the first of the two meetings of the Association under his presidency.

The meeting was a success; the excursion was even more so. I surmise that it is owing to the personal respect in which Mr. Bell is held in the Dalkeith district that the Association were invited to visit the latest constructed pit in the Newbattle collieries. The great shaft was sunk by the owners—the Lothian Coal Company—about five years ago, for the concentration of their workings in several collieries which they own in the immediate neighbourhood. The workings extend for miles on either side. As the company approached the colliery, they passed, about a mile off, the stately castle of Dalhousie, upon the towers of which the sun shone with splendour; and before descending the shaft they were informed that their underground walk would carry them to the region below the castle grounds. At the bottom of the shaft, in another direction, down a steep incline, with insufficient headroom to enable a person to walk upright, involving a two-mile walk, it was explained, lay the workings of the famed Newbattle cannel. On account of the difficulty of reaching the place, and the time which would be occupied in traversing the narrow mine, the visit to the cannel workings was reluctantly given up. Everyone was, however, supplied with a piece of cannel, as a souvenir of the occasion. The visit of inspection over, the visitors were hospitably entertained by the Coal Company; and the usual courtesies followed. The Association are undoubtedly indebted to Mr. J. A. Hood, the General Manager of the Company, and Mr. John Callendar, the



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Secretary, for the welcome they extended to the Association and the attention they showed them. Such fraternity between the producers of coal and so large consumers of it as are gas undertakings, is worthy of recognition and commendation. It ought not to be omitted to add here that all the arrangements for the meeting were most carefully made, and their progress superintended by the Hon. Secretary of the Association, Mr. A. C. Young, of Kelso.

Not since the time when the Edinburgh and Leith Gas Commissioners were appointing a Chief Engineer has there been so much excitement over a vacancy in Scotland as there is at present over the selection of a Manager of the Greenock Gas-Works. There is a very large list of applicants; the place being, I think, the fourth largest in Scotland. The competition is very keen. The Corporation have a list of excellent men before them; and it will be their own fault if they do not choose a man who will be all that Mr. Stewart has been to them—one of the best men of his time.

Out of this appointment at Greenock, there has arisen one of the most pleasant incidents which I have yet recorded in these pages. Mr. A. Yuill, of Alloa, was one of the applicants for the post. On Monday of this week, at a meeting of the Gas Commissioners of the burgh, Bailie Arrol, the Convener of the Works Committee, said that he had contemplated in the near future moving that Mr. Yuill receive an increase in salary. The most opportune time, he thought, to make such a proposal, would have been when the present improvements at the gas-works had been completed. However, circumstances had arisen which had prompted him to bring the matter before the Commissioners that evening. At present the Gas Commissioners of Greenock were on the look out for a Manager; and Mr. Yuill had been asked to put in an application for the position. The salary offered was £400 per annum to start with. They all knew how faithfully Mr. Yuill had served the Commissioners and the ratepayers since he had taken over the management of the works. Besides being able to supply the community with gas at a price which could only be beaten by one other town in Scotland—viz., Hamilton—Mr. Yuill had in many ways saved the pockets of the ratepayers. In connection with the alterations which from time to time had taken place at the works, the Commissioners had been saved the payment of architects' fees; Mr. Yuill having drawn the plans and specifications. The many improvements had turned out successful; and in the results attained the figures estimated by Mr. Yuill had in almost every instance been fully realized. It would be a misfortune to the burgh if they were to lose Mr. Yuill's valuable services. As he had already indicated, they were in the fortunate position of keeping the gas at 2s. 6d. per 1000 cubic feet; while Glasgow, Edinburgh, Dunfermline, and other places, had to raise the price of their lighting commodity. The only place which was lower than Alloa was Hamilton; and the Gas Commissioners of that town were in the unique position of being able to cart the coal right from the pit-head to the gas-works at very small cost. They had also under their charter no need to make any provision for a sinking fund, and had altogether a freer hand in financing their undertaking than the Alloa Commissioners had. Taking everything into account, he thought the Commissioners should recognize Mr. Yuill's services by offering him some substantial increase on his present salary, £275; and in order to put the matter in proper form, he moved that Mr. Yuill's salary be increased to £350, the advance to take effect from the first of next month. The proposal was agreed to unanimously; and next day Mr. Yuill withdrew his application. The action of both parties is commendable. Mr. Yuill has been about fifteen years in Alloa. During this time he has so managed the undertaking that, while the output of gas has risen from 30 to 60 million cubic feet, the price has been reduced from 3s. 9d. to 2s. 6d. per 1000 cubic feet; and not only so, but he has been extending and improving the works, upon a plan foreseen from the beginning, at a cost, taken from revenue, of over £20,000. He is, it may be said, just getting into a position where he might expect to rest upon his oars—reaping, without effort, the fruit of his labours. It will, therefore, be more pleasant for him to remain in Alloa than to go elsewhere and enter upon new and arduous tasks. It has been a feature of Mr. Yuill's management all along that he has always been willing to adapt new methods of working, wherever he could; and it is, according to my observation, the manager who fearlessly shapes his course out of the beaten track, who succeeds in life. There are working processes which are languishing in the market because no one has the spirit to take them up, and which would have made the name of any gas manager. Men go to meetings and hear papers and discussions; but they do nothing with the knowledge they acquire. Such was not the way with Mr. Yuill.

Dealing still with appointments, I come to that at Forfar, which was made last night, and resulted in the election of Mr. James Baxter, at present Manager at Armadale. There were 37 applicants for the post; and on Monday the Gas Corporation met and selected the following short list of six: Francis Chalmers, Gas Manager, Spittal, Berwick-on-Tweed; James Baxter, Gas Manager, Armadale; J. B. Terrace, Gas Manager, Brechin; William Whyte, Gas Manager, Renton; Charles M'Pherson, Assistant, Aberdeen; and Mr. F. W. Carlow, Gas Manager, Lasswade. At the meeting last night, Mr. Christie moved that the election be by ballot, because, he said, he had received letters from five different business acquaintances and friends, pressing him to vote for a certain candidate. It was not every man who could afford to give offence to influential business acquaintances, as it meant the destroying of his bread and butter. The motion was ruled incompetent; and the vote was taken openly. Bailie Hanick, the Convener of the Gas Committee, moved the appointment of Mr. Baxter. The others who were moved were Mr. Terrace and Mr. Whyte. The vote resulted: Baxter, 9; Whyte, 4; and Terrace, 2. Mr. Baxter, having a majority over the other two, was declared to be elected. He is about 36 years of age. He was a plumber to begin with, and has been Gas Manager at Innellan, Renton, Berwick, and Armadale

The "North British Daily Mail" of to-day publishes the following paragraph relating to the state of affairs in connection with the Greenock Corporation gas undertaking: "From the report of the Sub-Committee appointed to investigate the affairs of the Gas Trust, it appears that there has been a loss of £700 to the Trust on account of contractors failing to implement their contracts. Yielding to pressure, some of the coalowners are said to be fulfilling their contracts; and the loss has in consequence

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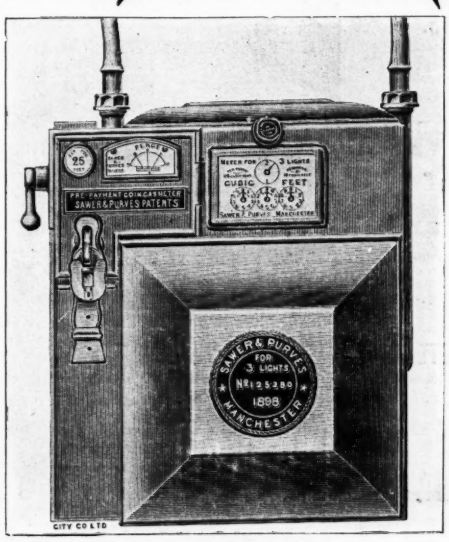

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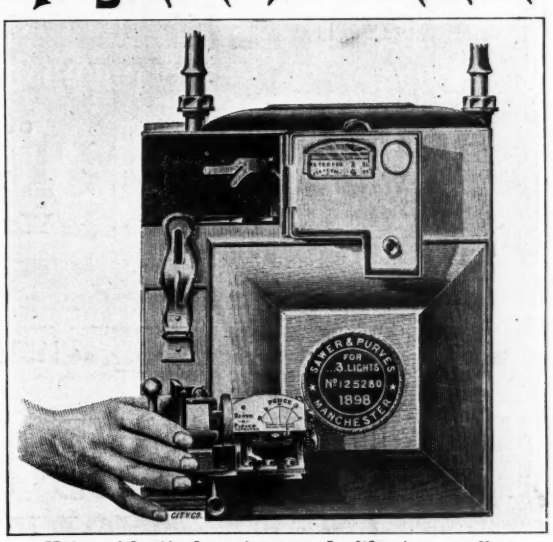

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been reduced by about £180. The Gas Committee before whom the Sub-Committee's report was laid, regretted that they had not been informed of the failure of the contractors to implement their contracts, and that the coal had been purchased without the Committee having been previously consulted. The Committee also regretted that the cash in the hands of the collector had not been disclosed in the public accounts." This report was before the Police Board on Thursday; but the matter does not seem to have been made clearer than this leaves it. Possibly, in view of a new appointment, it may be better to drop the subject, as the defects cannot now be made good.

The Finance and Law Committee of the Edinburgh and Leith Gas Corporation on Monday considered a report by their Treasurer (Mr. John S. Gibb) to the following effect: "As the price of gas for the coming year has to be considered and settled at the meeting of the Commissioners on the 24th inst., and judging that you might wish to make a recommendation on the subject to that meeting, I beg, at the request of the Convener, to enclose copy of my estimate of revenue and expenditure for the present year, based on the actual figures for the year last closed. In determining this estimate, I have had the benefit of the aid and experience of the Chief Engineer, who has carefully examined and approved the items belonging specially to his own department—viz., the expenditure for manufacture and distribution, and income from sale of gas and residual products. Supposing the output and price of gas to continue the same as last year, the estimate shows a probable deficit of £52,100. A penny per 1000 cubic feet represents £7185; the estimated deficit is, therefore, as near as may be, equal to 7¼d. per 1000 cubic feet. My calculation takes for granted the renewed suspension of the sinking fund for repayment of money borrowed for new works at Granton; and the minimum statutory allowances for the other sinking funds. Interest on money borrowed has been considerably increased, but not more than almost certainly will be required. The deficit is caused almost entirely by the abnormal increase in the price of both coals and oil. This is responsible for £51,979, or within £121 of the total deficit. Two courses are open to the Commissioners for meeting the emergency—either (1) to raise the price of gas the full sum needed to make the income and expenditure of the year balance one another; or (2) to raise the price so as partially to meet the deficiency, and, for the remainder, draw on the working balance of £28,349 brought forward from last year. Supposing the latter method were adopted, and the price raised, say, 4d. per 1000 cubic feet, £23,353 would be required from the working balance to make expenditure and income square, leaving only £4996 unappropriated. Should the cost of coal and oil continue unchanged, a further rise in the price of gas would be required next year." After discussion, the Committee agreed to recommend that the price of gas be raised by 4d. per 1000 cubic feet, making it 3s. 4d.

Following upon the announcement which I made in the "JOURNAL" of Aug. 21, of the collapse of a gasholder at Milngavie, there comes the report that this week a deputation from the Gas Company waited upon the Burgh Commissioners, and said that this was a most opportune time to offer the gas-works to the Commissioners. On account of the mishap, the Company were negotiating for more space for the erection of a new gasholder, and even for the changing of the site of the gas-works, to suit the growth of the burgh. A special meeting of the Commissioners is to be held to consider the matter.

At a meeting of the Committee of the Arbroath Gas Corporation on Tuesday, the Manager (Mr. R. S. Carlow) stated that they had been very fortunate this year so far as the coal contracts were concerned. Last year the average price of their coals was 19s. 4d. per ton; while this year it was 22s. 6d.—the increase being small, considering the heavy rise in the price of coal in the country. The Finance Committee met last night, and agreed to recommend that the price of gas be increased by 2½d. per 1000 cubic feet, making it 4s. 4½d.

The Directors of the Annan Gas Company, finding that it would be necessary, in the ordinary course, to raise the price of gas by 6d. per 1000 cubic feet, have resolved to divide with the consumers the loss which will be sustained in working, and to raise the price by only 3d.

The Falkirk Gas Commissioners are in the fortunate position of not requiring to raise the price of gas. At their meeting on Wednesday, they resolved to retain it at 3s. 9d. per 1000 cubic feet. The estimates for the current year showed a probable revenue of £22,742, of which £18,842 is expected from gas, £2044 from coke, and £1748 from tar and ammoniacal liquor; and a probable expenditure of £18,340, of which coal is estimated to cost £10,682, or about £3000 more than last year. The gross surplus is estimated at £4402, to which falls to be added the balance brought forward of £1429, making £5831. The capital charges amount to £4962; and there is thus an apparent surplus of £869. It will be seen that the situation is saved by the balance brought forward, as without it there would be a loss on the year's working of £560. But, of course, the financing is perfectly sound. In speaking to the estimates, Provost Weir very properly gave due credit to the good management of Mr. Kincaid, as having enabled them to go on without raising the price of gas. With such a high capital as there is in Falkirk, and the prospect of its rising still higher, it undoubtedly is evidence of good management, and of confidence in the Manager, when the Commissioners arrange for the eating up of an accumulated balance.

Proceeding upon a report by Mr. G. Malam, of Dumfries, the Kirkcudbright Gas Commissioners have resolved to reconstruct the retort-house in their works, and to make other improvements, at an estimated cost of £450. Mr. Malam suggested the erection of a new gasholder of 18,000 cubic feet capacity, at a cost of £1100; but this portion of his report has been delayed till it be seen whether it may not be possible to continue without a new holder.

The annual meeting of the St. Andrews Gas Company was held on the 7th inst. It was stated by the Chairman (Mr. J. R. Welch) that the output of gas during the year was 1,923,000 cubic feet more than in the preceding twelve months, and that the quantity of coal carbonized was between 4000 and 5000 tons. The Managers and Directors had had an anxious time during the year, in consequence of the continued increase in the price of coal, which had cost them about £1200 more than they previously paid. The present price of gas is 3s. 9d. per 1000 cubic feet without meter-rent. The number of consumers had increased by 57. There are now 124 consumers with prepayment meters. The Chairman

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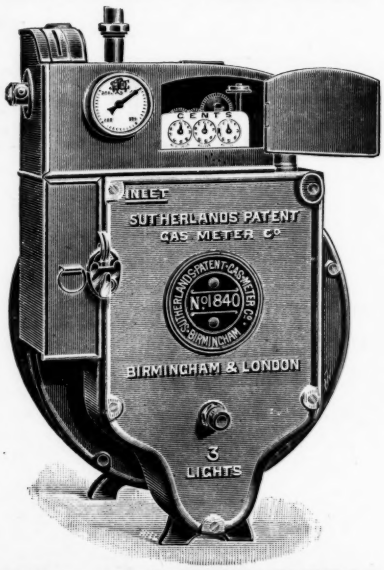

THE SUTHERLAND GAS-METER COMPANY
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acknowledged that the satisfactory position of the Company's affairs was largely due to the excellent way in which the Managers (Mr. Jesse Hall and his son, Mr. R. Hall) had conducted the business; and he moved that the thanks of the shareholders to them be engrossed in the minutes. The Directors proposed to convey their coal by sea, instead of by rail, on account of the congested state of the mineral traffic at St. Andrews. The cost of the carriage of the coal to St. Andrews by rail was about £700 a year. There had been some friction between them and the Railway Company, as to demurrage; but this would not occur again. A shareholder congratulated the Company upon the low price of their gas, which, he said, was 5d. per 1000 cubic feet less than in a town he had recently visited, which was much nearer to the coalfields than they were. The report was adopted.

The Directors of the Cowdenbeath Gas Company, whose retort-house was destroyed by fire a fortnight ago, have resolved to rebuild the house with coal-gas plant in it, if they get sufficient support. It has always been a puzzle to most people to understand why a gas company in the heart of the Fife coalfield should ever have given up the manufacture of coal gas. There should, it may be premised, be no difficulty in the matter of support for a coal-gas supply, if the proposals of the Company are reasonable.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 15.

Sulphate of Ammonia.—The tendency of the market is still in favour of buyers; the closing quotations being £10 12s. 6d. to £10 15s. per ton, delivered f.o.b. at the ports. Scotland has been the weakest point, as low as £10 11s. 3d. per ton having been accepted f.o.b. Leith. Elsewhere supplies have been rather plentiful; the dropping of the forward price in London having discouraged makers who were disposed to resist the downward movement, and encouraged buyers to hold aloof. In the forward position, London, Beckton terms, is quoted £10 12s. 6d. per ton, delivery up to March; while speculators have "gone one better," and sold abroad at below the equivalent.

Nitrate of Soda remains quiet at 8s. 1½d. to 8s. 4½d. per cwt., according to quality, on spot. Forward is also quiet; but prices are unchanged—producers being very firm, and tonnage difficult to find.

LONDON, *Sept.* 15.

Tar Products.—Trade continues very unsatisfactory; and many distillers are losing heavily on contracts entered into at high prices some time ago. The extraordinary drop in the value of creosote, and the neglected condition of some of the other products like anthracene and naphthas, have seriously affected the initial value of tar. There is no change in the price of benzol and its congeners. Solvent naphtha is a little firmer; and carbolic acid is steady. But taking the market all round, there is a feeling of depression and anxiety.

The average values of the week are: Tar, 15s. to 23s. Pitch, east coast, 37s.; west coast, 32s. 6d. Benzol, 90's, 10d.; special qualities for gas, 10½d.; 50's, 11d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d.; crude naphtha, 3¾d.; heavy naphtha, 1s. Creosote, 1½d. to 2d. Heavy oils, 2¾d. Carbolic acid, 60's, 2s. 10½d. Naphthalene, 70s.; salts, 45s. Anthracene, nominal, "A," 3½d. to 4d.; "B," 2½d.

Sulphate of Ammonia.—A fair amount of business has been done. In every case buyers have had the advantage. It is curious, seeing that there is very little sulphate being made, and not much offering, that buyers should be so indifferent. The value at all ports may be taken at an average of £10 12s. 6d., less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The only special feature to notice in connection with the coal trade here is that, while round coals fully maintain their strong position, there is undoubtedly a weakening as regards engine classes of fuel. This is particularly noticeable in the shipping trade, where colliery proprietors are getting quite 2s. per ton above what they are quoting on inland sales for round coals; while, on the other hand, engine fuel is being sent away for shipment at about 1s. below the basis of pit prices for inland business. Delivered at the Mersey ports, good qualities of screened coal are fetching from 17s. to 18s. per ton, with slack obtainable at about 11s. to 11s. 6d. This state of affairs is easily explained. In round coals, the inland demand is sufficient to take away the whole of the output; and shipping orders are only being entertained where some substantial advance can be secured. With regard to engine fuel, however, the demand for mill purposes has been restricted, owing to the holidays during the past month and the unfavourable outlook in the cotton industry; and the activity in the round coal trade has necessarily involved a large production of slack. Supplies have consequently exceeded requirements; and to maintain inland prices, collieries have either had to put into stock or send away surplus lots for shipment at lower figures. As to the inland trade, house coals are in brisk request, with prices firm; and some further upward move with the close of the month is regarded as not improbable. Steam and forge qualities meet with a good demand, and list rates are fully maintained; but any further advance in them is not considered likely. For engine fuel, the inquiry is fairly active, but not so heavy as it has been; and though Lancashire collieries still quote about late rates for good sorts, inferior descriptions are obtainable at much lower figures, and from other districts cheap parcels continue to be offered. At the pit, best Wigan Arley may be quoted about 16s. 6d. to 17s. per ton, Pemberton four-feet and seconds Arley 15s. to 15s. 6d., common house coal 14s. to 14s. 6d., steam and forge coal 12s. 6d. to 13s., and good qualities of rough Lancashire slack about 10s. 6d.

Northern Coal Trade.—There is still great activity; and the quantities sent from some of the shipping docks this month are higher than in any similar period. Steam coals are, however, a trifle easier, as the end of the Baltic season is approaching. Best Northumbrian steam coals

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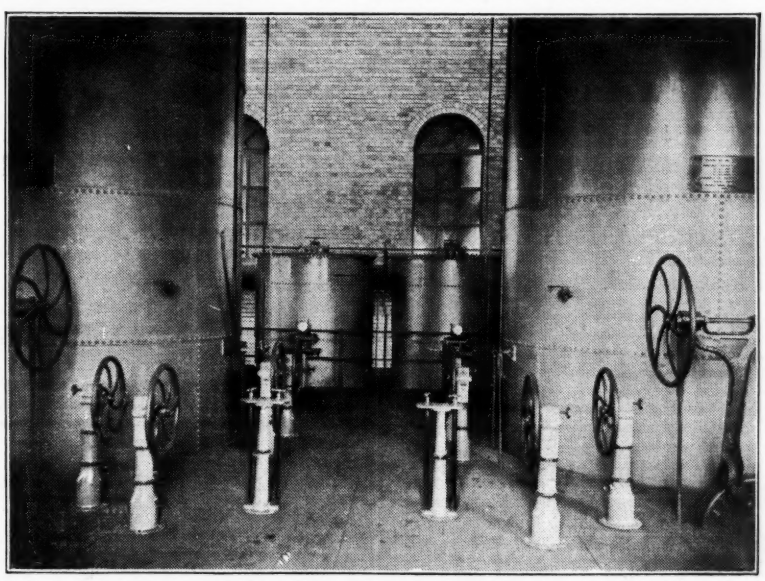

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
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are quoted from 19s. to 20s. per ton f.o.b., with a good demand for prompt delivery, though with some falling off for forward delivery. Steam smalls are from 11s. 6d. to 12s. In gas coals, there is a full output; but it is well taken up, and the demand for the large contracts is now increasing so satisfactorily that there is less coal for casual sale. For such sales 18s. per ton f.o.b. is asked; while for contracts over the whole of next year, the general quotation is still 16s. In the coke market, the demand is rather reduced; the shipments to the Baltic now falling off, as is usual at this time of the year. For best Durham coke 31s. to 33s. per ton f.o.b. is the quoted price; and for blast furnace coke 28s. at the furnaces. Gas coke is now in rather fuller supply; but both for factories and for export very high prices are asked—as much as 24s. per ton f.o.b. having been quoted for gas coke for shipment. There are, of course, deliveries on contract at lower prices.

Scotch Coal Trade.—There is demand for more than the output. The latter could be increased if the miners would work more steadily. But this would lead to a reduction in prices, followed by lower wages; and neither masters nor men are enamoured of the approach of the period of smaller returns. Another class of people who are beginning to quake at the prospect of a fall in prices are the middlemen who have sold forward, but have not been able to buy forward to cover all their sales. The policy of these folk is that of "hedging;" and it is being largely adopted. The forces which control the market are thus all combined against the consumer. Prices scarcely vary, and may be given as: Main 15s. 3d. to 15s. 6d. per ton f.o.b. Glasgow, ell 16s. 6d. to 17s. 6d., and splint 17s. to 17s. 6d. The shipments for the week amounted to 261,502 tons—a decrease of 9296 tons upon the previous week, but an increase of 48,842 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,397,033 tons—an increase of 1,323,043 tons upon the corresponding period of last year.

The Wages of Stockton Gas Workers.—A deputation of labourers employed at the Stockton Corporation Gas-Works, accompanied by Mr. Lynas, of the Gas Workers' Union, waited upon the Chairman of the Gas Committee and the Manager (Mr. William Ford) yesterday week, with reference to their claim for 2s. a week advance in wages. The result of the interview is that the Committee are to be recommended to increase the wages of the labourers, which vary between 23s. and 24s., to 25s. a week all round.

Proposed Extension of the St. Mary Church Gas-Works.—It was decided by the St. Mary Church District Council on Thursday to apply for a Provisional Order to raise £10,000 for gas-works purposes. Mr. Grant explained that the Council originally had power to borrow £15,000, nearly all of which had been spent. They were constantly extending the works; and it was necessary now to make further enlargements and provide better apparatus to cope with the increased demand for gas. The scheme for the amalgamation of the district with Torquay had delayed the work; but he thought the Manager (Mr. T. Evans) would be able to get through the winter satisfactorily.

The Healthfulness of Gas-Works Employment.—A Bethesda gas-works man is said to have unsuccessfully asked the District Council for more salary because, since he had been at the gas-works, his appetite had greatly increased, and he had to take an extra meal daily.

The Price of Gas at Totnes.—The suggestion of the Directors of the Totnes Gas Company (see *ante*, p. 601), to meet the trouble threatening in the town in consequence of the recent advance in price, has been accepted; and all the consumers have now paid their gas accounts in full without further demur.

Bedford Gas Company.—The half-yearly report of this Company showed receipts amounting to £14,734, an increase of £1200, and that 80,408,000 cubic feet of gas had been sold, an advance of nearly 4½ millions. The Directors stated that the Company held a larger stock of coal than ever before; 6000 tons having been secured before the recent rise. The Company's Bill had been passed in Parliament; and the best possible understanding existed with them and the Corporation.

The Purchase of the Skipton Gas-Works by the District Council.—With reference to the report of the proceedings at the winding-up meeting of the Skipton Gas Company which appeared in the "JOURNAL" for the 4th inst., it should be mentioned that in addition to the £66,500 awarded to the Company, the Urban District Council agreed to take over a mortgage of £4750; bringing up the purchase price virtually to £71,250, the amount previously stated in our columns. The shareholders have received £300 for each £100 of 9 per cent. stock, and £250 for each similar amount of 7½ per cent. stock.

Matlock Bath Gas Affairs.—The minutes presented by the Gas Committee at the meeting of the Matlock Bath District Council last Tuesday stated that the Auditor had certified the accounts for the year ended March last; and the profit on the gas undertaking amounted for the year to £938, to which should be added another £40, which had been charged to revenue, but belonged to capital account. A letter was read from the Auditor which recommended a question regarding the position of the Council in relation to the Matlock Bath Gas Act being referred to the Local Government Board. There had been £10,000 allowed by the Act for extension and removal of works; and the Auditor questioned whether the money could be used for any other purpose.

The Gas-Works Purchase Scheme not to be Proceeded with at Rushden.—At Wednesday's meeting of the Rushden Urban District Council, the Committee appointed to further consider the matter of the purchase of the gas-works, reported that, after careful investigation, they were satisfied the undertaking could not be acquired on more favourable terms than those set out in the report of the Special Joint Committee of the Councils of Rushden and Higham Ferrers made in February of last year, and then submitted to a town's meeting. The Committee also gathered from reports of recent arbitrations that the amounts awarded on compulsory purchases generally exceeded the figures named in the report of the Joint Committee. Under these circumstances, and having in mind the manner in which the proposed purchase was received by the town on previous occasions, the Committee did not recommend the Council to take further steps in the matter. The report was adopted.

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SULPHATE OF AMMONIA PLANTS.

Incandescent Lighting in the City of London.—This form of light for the side-streets of the City is being gradually extended. About 100 lamps have already been put up in some of the more important of these minor thoroughfares—viz., Fetter Lane, London Wall, Paternoster Row, &c. The burners consume 4·25 cubic feet of gas per hour, and one-third of a foot per hour during daylight on the pilot light—giving a duty of about 80 candles.

St. Albans Gas Company.—At the recent half-yearly meeting of this Company, the Chairman (Mr. Kent) stated that their continually increasing business had overtaken the extensions made to the works five years ago, and they were obliged to erect another retort-house and larger station-meter. Before another winter, a new gasholder and larger purifiers would be required. Towards meeting this outlay, £5000 of stock was recently sold. For the current year's coal contract, they had to pay an advance of 5s. 6d. per ton; and the price of gas had in consequence been raised 4d. per 1000 cubic feet.

The Wentwood Water-Works of the Newport Corporation.—Under this title a paragraph appeared in our news columns on Aug. 28 reporting a statement made by Colonel Lyne, the Chairman of the Newport Corporation Water Committee, on the occasion of a visit of the members to their new water-works at Wentwood. In the course of this paragraph, it was incidentally remarked that the estimate for the Birmingham Corporation Welsh water supply scheme was being exceeded by 200 per cent. Mr. James Mansergh, M.Inst.C.E., the Engineer to the scheme (whom we regret should have been troubled in this matter), asks us to state that the figures "quoted from Colonel Lyne's speech are grossly inaccurate in every particular." It now appears that the statement by Alderman Lyne to which Mr. Mansergh naturally objects was made on what the speaker regarded as a private occasion. This is evident from a brief conversation which took place at last Tuesday's meeting of the Newport Town Council, and was reported as follows in the "South Wales Daily News:" Alderman Lyne, Chairman of the Water Committee, drew what he called serious attention to the necessity for care in the use of water, as there was only 44 days' supply in hand. Mr. R. Wilkinson found another serious matter which he said the Chairman had not alluded to—namely, that the borrowing powers of £256,000 for the Wentwood scheme were nearly exhausted—and asked the Chairman to tell him what the probable total cost would be. Alderman Lyne replied that he could not answer an impossible question, but declared that when the scheme was completed it would be a great success. "Would the worthy Alderman give me his opinion," insinuated Mr. Wilkinson. "I have not the slightest idea," retorted the Alderman; whereupon Mr. Wilkinson turned to a report of the Alderman's speech at a recent lunch, where he said the cost would be about £200,000. Alderman Lyne said he declined to reply to questions on private speeches at a lunch. He was sorry that what he said had been reported. He said at the time, "I am happy to see there are no reporters present, and so I can open my mouth freely." Mr. Wilkinson: Would you say whether it is a correct report of your speech? Alderman Lyne: It was partially correct, and partially incorrect.

A Large Coal Conveying Belt at Sheffield.—The Rosendale Belting Company have recently supplied the Sheffield United Gaslight Company with one of their patent waterproofed belts for conveying coal and cannel. It is 750 feet long, 2½ feet wide, and eight-ply thick, and weighs nearly 2¾ tons. The belt will convey 65 tons of coal per hour, when running at the rate of 200 feet per minute. It is driven by a pulley 3 feet in diameter, and is supported on concave rollers 7 feet apart, and passes through a movable carriage which throws the coal off at any point in the length of the coal stores.

Hoylake and West Kirby Gas and Water Company.—The Secretary of this Company (Mr. A. G. Readdy, F.I.S.) forwards a neatly got-up "Souvenir" of the undertaking—a little book containing a brief review of the career of the Company from its formation to date. The majority of the details furnished were given in the Chairman's speech upon the occasion of starting the new Simpson pumping-engine at the West Kirby Water-Works, on Dec. 2 last; but, with the aid of photographs of some of the plant, and a map showing the authorized area of supply, Mr. Readdy has made the production interesting to all residents in the locality and others not so intimately concerned with the rapid growth of the place.

The Lighting of Holsworthy.—A difference of opinion between the Holsworthy Gas Company and the District Council, as to the charge for public lighting, led to the streets being without light from the early part of the present month until Thursday evening last. The Council refused to accept the Company's tender; and, as an alternative, they offered to pay either 28s. per lamp or 6s. per 1000 cubic feet of gas consumed, with 5s. for waste, or to settle the account by arbitration. The Company declined all these proposals at first, but ultimately decided to accept the offer of arbitration, and the lamps were lit on Thursday evening. A meeting of the ratepayers is to be held to consider whether the gas-works should not be purchased by the Council.

Street Lighting in York.—Last Friday's "Yorkshire Chronicle" mentions editorially the recent starting of the electric lighting of some of the city streets. It is said: "At last we have seen some of the street electric lights; and, curiosity being satisfied, it is 'the thing' to compare notes and impressions. So far there seems to be little to be enamoured about. What looked all right in the daytime, hardly bears examination at night; and the effect is by no means so luminous as was expected generally. The lamps seem to be badly placed in relation to each other, and are not sufficiently numerous. In some streets, at any rate, unless we are to be satisfied with worse lit streets, some if not most of the existing gas-lamps will have to be retained. Under the circumstances, it is not to be wondered at that the Gas Company's Secretary, Directors, and shareholders were able to look happy at their general meeting. A few years ago the contrast in the street-lighting would have been very marked on the installation of the electric supply; but really the advances in gas-lighting, especially since the advent of the incandescent mantle, have been so real and great that the competition between the two is fought out on a much nearer level. And apparently gas is not going to be dethroned yet, at any rate in York."

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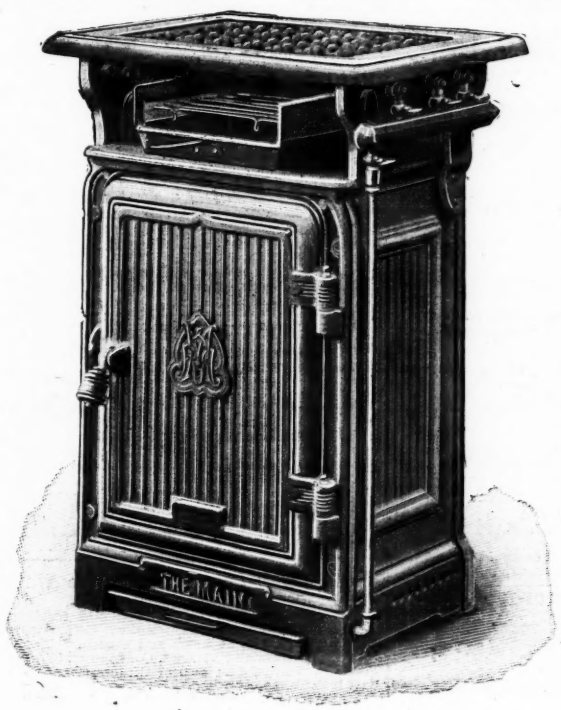

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The Nuneaton Gas Company Require Additional Capital Powers.—The Nuneaton Gas Company have given notice of their intention to apply to the Board of Trade for a Provisional Order, authorizing them to raise additional capital to the amount of £50,000.

Proposed Water Board for Southport.—Last Wednesday, a meeting of representatives of the Southport Corporation, the Birkdale District Council, and the West Lancashire District Council met, under the chairmanship of the Mayor (Alderman Griffiths), to formulate a scheme for acquiring the water-works. Information as to the population, rateable value, &c., of the districts covered was laid before the meeting; and it was decided to obtain information with regard to Water Boards in other places before proceeding further.

Levelling the Wages of Bradford Gas Workers with Those at Leeds.—Last Friday a deputation from the Gas Workers' Union waited upon the Gas Committee of the Bradford Corporation with reference to the wages paid to the purifying men and yardmen employed in the department. The Committee recently increased the wages of the purifying men from 6d. to 6½d. per hour; and those of the yardmen from 5½d. to 5¾d. per hour. The deputation asked that a further increase of a farthing per hour should be conceded in each case, in order to bring the rates up to those in force at Leeds. The Committee granted the application.

Ottoman Gas Company, Limited.—The Directors of this Company in their report for the half year ended June 30 state that the gas-rental amounted to £10,000, as against £8869 in the corresponding period last year; and the net profit is £2654. The amount standing at the credit of profit and loss account is £3366, from which the Directors recommend a dividend at the rate of 7 per cent. per annum on both classes of shares. This will absorb £2625, and leave £741 to be carried forward. The Directors report, with pleasure, that since the last meeting they have renewed the public lighting contract with the Municipality of Smyrna. They also mention that Mr. Strachan C. Clarke has joined the Board.

East Dereham Gas Supply.—At the last monthly meeting of the East Dereham District Council, the Chairman of the Gas Committee (Mr. T. Cranmer) reported on the working of the gas undertaking in the year ending the 31st of March last. He said the accounts showed a net profit for the year of £716. Out of this, £296 had been paid for interest; and the balance, £420, had been added to the amount brought forward, increasing it from £2389 to £2809, which represented the total profit made since the works were purchased, beyond the amount paid for interest. In the past year, the gas sold realized £1896, against £1657 for 1898-9; being an increase of £239. The make of gas was also higher for the past year by 652,600 cubic feet. The receipts for residuals in 1898-9 were £220; being the lowest of any year since the gas-works had been in the possession of the Council. The receipts for the year 1899-1900 were £476, or more than double. The gas made per ton of coal carbonized in 1898-9 was 9480 cubic feet, and last year 10,280 cubic feet; being 800 feet more per ton. This year's working showed a decrease of 3·84 per cent. in the quantity of coal used, and an increase of 4 per cent. in gas made. The gas unaccounted for last year was 847,500 cubic feet, against 1,118,370 cubic feet in 1898-9. The cost of coal per ton in 1898-9 was 17s., and last year 18s. For the ensuing year the contract figure was 23s. 4d.; and in consequence of the present price of coal, there could be no reduction in the charge for gas for the current year. The list of repairs passed by the Council, with one or two exceptions, had been satisfactorily completed by the Manager (Mr. H. Kitson) and his staff of workmen at over 50 per cent. less than the estimated cost.

A Loan for Gas Cookers and Meters for Malvern.—Mr. W. A. Ducat conducted a Local Government inquiry at Malvern last Friday respecting an application by the District Council for sanction to borrow certain sums of money. One of them was £3000, which is required for the purchase of gas cookers and meters.

Luton Water Company.—At the 65th half-yearly meeting of this Company, the report stated that the two new water-towers to supply the highest parts of the town were nearly completed. The balance of the net revenue account was £3265; and this sufficed to pay the maximum dividend and carry forward £854 to the renewal and contingency fund, which now stands at £6441. The Chairman pointed out that £15,000 had been spent during the past twelve months on buildings, mains, and extensions.

Opening of New Water-Works at Newton-le-Willows.—The official opening of the new water-works for Earlestown and Newton-le-Willows (Lancs.) took place last Thursday. The whole scheme drawn up by the Urban District Council is estimated to cost £23,000; and this is divided into three sections. The first section was that which was opened last week, whereby over 3300 consumers will receive for a considerable period water which has been pronounced as excellent. This first section of the scheme has cost nearly £7000 to institute. Duplication of the plant forms the second section; and this will be started almost immediately. The saving to the ratepayers is considerable; and the institution of the Council's own water-works has been a matter of congratulation on all sides.

The Dorking District Council to Purchase the Water-Works.—At Thursday's meeting of the Dorking Urban District Council, the Chairman (Mr. W. J. Palmer) moved—"That, in the opinion of this Council, it is desirable to apply for power to take over the Dorking Water Company's undertaking at the earliest possible moment; and that the Clerk be and is hereby instructed to take such steps as may be necessary for promoting a Bill in the next session of Parliament, either in conjunction with the Dorking Rural District Council, or, in case that Council be not willing to co-operate, then on behalf of this Council alone, for the purpose of taking over the undertaking, pursuant to powers conferred jointly and severally upon this Council and the Dorking Rural District Council by section 26 of the Dorking Water Company's Act, 1900." Mr. Palmer said the principle had been already adopted; and he thought the only question which the Council really had to consider was, as to whether this was the proper time to apply for power to take over the Company's undertaking, or whether the matter should be allowed to stand over until the succeeding session of Parliament. His own opinion, as they knew, was strongly in favour of taking action at once; and he would be glad to see this course adopted. He would also be glad to have the unanimous vote of the Council on the subject. They had had no official intimation of the action which was to be taken by the Rural District Council; but they would probably hear from that authority in due course. The motion was seconded by Mr. Clift and carried.

The Morecambe Gas Company have placed the order with Messrs. R. Dempster and Sons, Limited, of Elland, for an elevator, &c., for lifting coke from the yard and depositing it in railway waggons.

The Enfield District Council have resolved to apply to the Local Government Board for permission to borrow £41,000 to increase the water supply of the parish—an amendment, that the New River Company should be asked to state the terms on which they would supply the parish, being defeated.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SADLER & CO., Ltd., Middlesbrough,

Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PORTER & CO., Gowts Bridge Works,

LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, see Sept. 4, p. 608.]

PRACTICAL RETORT SETTERS.

GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

FIRST-CLASS Incandescent Gas-Mantles, also all other Articles in this line, are manufactured, carried on a large scale, and exported to all parts of the World by
GESELLSCHAFT FUR GLUHLICHT-BELEUCHTUNG, DRESDEN.
Telegraphic Address: "GLUHLICHTFABRIK."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

YOUNG Man (27 years of age) wishes a permanent Situation as BLACKSMITH, IMPROVER, and RETORT-HOUSE FITTER in Gas-Works. Seven Years' References.
Address No. 3561, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOREMAN Mainlayer wants employment. First-Class Testimonials. Would like permanent work at home, or would go abroad for a term.
Address No. 3560, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

INSPECTOR wanted for Gas and Water Works in scattered Country District. Must be cyclist, and energetic.
Apply, with full Particulars as to Abilities and Salary required, to the SECRETARY, Mid Kent Water Company, Snodland, KENT.

WANTED, by a Gas Company about 30 miles from London, a competent FITTER and MAINLAYER. Permanent Employment to a steady Man. State Wages required.
Apply, by letter, to No. 3558, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROTHERHAM CORPORATION.
(GAS DEPARTMENT.)

WANTED, a competent Main and SERVICE-LAYER. Permanent Situation to a suitable Man.
Apply, stating Wages required, to the undersigned.
FRANK A. WINSTANLEY,
Engineer and Manager.
Gas Offices, Rotherham.

CITY OF BRADFORD.
(GAS DEPARTMENT.)

THE Gas Committee invite applications for the position of ASSISTANT GAS ENGINEER, at a Salary of £300 per annum.
Candidates must have had a thoroughly practical experience in Gas Engineering and Gas-Works Management.
Applications, endorsed "Assistant Gas Engineer," and stating Age and Qualifications, with *copies* of not more than three recent Testimonials, to be addressed to me on or before Sept. 20.
Canvassing will be considered a disqualification.
FREDERICK STEVENS,
Town Clerk.
Town Hall, Bradford,
Aug. 31, 1900.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

MANAGER'S ASSISTANT.

WANTED, a competent Man to assist the Manager at the Works. Wages commencing at £2 10s. per week, with Residence on the Works, Fuel, and Light.
Applicants must have a thorough practical knowledge of Gas Manufacture on modern Principles, particularly Gaseous Firing and Inclined Retorts, and must also understand Photometry and the Analysis of Gas. Previous control of Workmen would be considered an advantage.
Apply, by letter, to the SECRETARY, 41, Sidney Street, CAMBRIDGE, stating Age and previous Experience, and enclosing *copies* of three recent Testimonials as to Ability and Character.

SHEFFIELD UNITED GASLIGHT COMPANY.

SUPERINTENDENT OF MAINS.

WANTED by the Directors of this Com- pany, an experienced and competent Man to superintend their Mains and Services Department. He must thoroughly understand the working of Governors, and be able to advise as to the correct sizes of Pipes required to ensure an adequate supply of Gas in all parts of the Company's district.
There are 460 miles of Mains in use at the present time.
Applications, marked "Superintendent of Mains," stating Age, Married or Single, previous Engagements, and Salary required, to be made by letter only, addressed to Sir Fredk. T. Mappin, Bart., M.P., Chairman of the Company, Gas Offices, Sheffield, not later than Friday, Sept. 28, 1900.
Testimonials not to be sent till asked for.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Sept. 4, 1900.

RICHMOND GAS COMPANY.

WANTED, Two reliable Foreman STOKERS, to take alternately Twelve-Hour Day and Night Shifts. Must be experienced in the work of a large Retort-House. Wages 50s. per week. Also an experienced MAIN and SERVICE LAYER.
Apply, by letter, with References, stating Age and Experience, to
THOMAS MAY,
Engineer and Secretary.
Gas-Works, Richmond,
Surrey.

THE Corporation of Halifax are pre- pared to receive Applications for the post of WATER-GAS PLANT OPERATOR. Three Men will be required, each upon Eight-Hour Shifts.
Applicants must have had experience in this work, and must state Wages required, Age, and full Particulars as to Ability and Experience.
Applications in writing must be sent to the undersigned.
THOS. HOLGATE, M.Inst.C.E.,
Engineer and Manager.
Corporation Gas-Works, Halifax.

SECOND-HAND VALVES WANTED.

TWO 8 inch or 10 inch diameter Four- Way PLUG VALVES.
J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

"CUTLER'S" Condenser, ¾ million day, equal to new; weight 12 tons; accept £100 on rail, Berkshire, if sold promptly.
J. F. BLAKELEY, Thornhill, DEWSBURY.

ADVERTISER, having duplicate Sets of the "JOURNAL" for 24 years up to 1893, would be glad to DISPOSE OF ONE OF THEM. The Volumes for the first Fifteen Years are bound; the remainder unbound.
Address No. 3559, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Two Tangye Horizontal ENGINES, 10 inch Cylinders, 20 inch Stroke, complete with Gas Exhausters, Pipes, Valves, &c. In excellent condition.
Address R. H. LONGBOTHAM AND CO., WAKEFIELD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

SECOND-HAND PHOTOMETERS.

MESSRS. Alex. Wright & Co., Ltd., have several second-hand EVANS & LETHEBY PHOTOMETERS, complete with Instruments in thorough working order and good condition, which they can offer at greatly reduced Prices.
Write ALEX. WRIGHT AND CO., LIMITED, Precision Works, 81, Page Street, WESTMINSTER, S.W.

GASHOLDER, Single-Lift, 14 ft. dia- meter by 10 feet deep, FOR SALE, constructed of Steel Sheets 16 W.G. and quite new, having three Channel-Iron Standards, with Suspension Gearing.
New LETHEBY PHOTOMETER, "Improved Edinburgh Model," by Sugg & Co. Specially designed for use in small office. Dimensions, 7 ft. 3 in. by 5 ft. 6 in. by 1 ft. 10 in.
For Prices apply to JAS. WRIGHT, Gas Engineer, Bridge House, Blackfriars Bridge, LONDON, E.C.

HIGH PRICED COAL.

SMALL Gas Authorities should im- mediately adopt an EXHAUSTER, and thus make probably at least 750 cubic feet of gas more from each ton of Coal carbonized. Several small sets *in stock*, both New and Second-hand.
Address J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

EXCELLENT SET OF PURIFIERS FOR SALE.

THE Yeadon and Guiseley Gas Company have FOR SALE a set of Four PURIFIERS, 14 feet square, complete with Centre-Valve, Connections, and Travelling Lift. Also a separate CATCH PURIFIER of same size, with Slide-Valves and Travelling Lift.
The whole are now in use in excellent condition, but must be removed in about a month.
Offers will be received, and further information given, by the Manager, Mr. E. Lister.
Gas-Works, Yeadon,
Aug. 28, 1900.

J. FIRTH BLAKELEY & CO., Thornhill, Dewsbury, have FOR SALE:—
One Set of Three 6-ft. PURIFIERS.
One " Two 8-ft. "
One " Four 8-ft. "
One " Four 16-ft. by 12-ft. PURIFIERS.
Four 5-inch ANNULAR CONDENSERS.
Four 10-inch " "
Six 16-inch " "
"Cutler" ¾ million WATER" CONDENSER.
Wrought-Iron TOWER SCRUBBERS, 3 ft. by 14 ft., 3 ft. 6 in. by 27 ft., and 7 ft. by 32 ft.
Cast-Iron TOWER SCRUBBERS, 3 ft. 6 in., 5 ft., and 6 ft. diameter.
EXHAUSTERS, 2000 to 60,000 Cubic Feet per hour.
"Holmes" & "Clapham" WASHER-SCRUBBERS.
"Livesey" & "Cripps" WASHERS.
4-in., 6-in., 8-in., and 10-in. STATION METERS.
Splendid GASHOLDER, 50 ft. by 20 ft.
RETORT IRONWORK, MODERN HYDRAULICS.
Telegrams: "BLAKELEY, THORNHILL LEES."

GLASGOW INTERNATIONAL EXHIBITION, 1901.

GAS LIGHTING.

THE Executive Council are prepared to receive PROPOSALS for EXHIBITS of INCANDESCENT and OTHER SYSTEMS of NOVEL GAS LIGHTING for Illuminating the Grounds and Detached Buildings of the Exhibition. For such Exhibits gas will be supplied free of charge.
Application to be made to the undersigned,
H. A. HEDLEY,
General Manager.
36, St. Vincent Place, Glasgow,
Aug. 30, 1900.

FOR SALE—Three 6-inch Bye-Pass VALVES cheap.
Apply to the MANAGER, Gas-Works, Romsey, HANTS.

BOROUGH OF ROCHDALE.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply of 26,000 gallons of 90 per cent. BENZOL, to be delivered at the Gas-Works, Rochdale, in about equal weekly quantities between Oct. 1, 1900, and March 31, 1901.
Forms of Tender and any further Information may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Benzol," must be sent in to me not later than Noon on Wednesday, Sept. 26, 1900.
By order,
JAMES LEACH,
Town Clerk.
Town Hall, Rochdale.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee are pre- pared to receive TENDERS for the supply of IRONMONGERY, LEAD PIPE, WROUGHT-IRON TUBES, GAS and WATER FITTINGS, OIL, &c., as may be required for the Half Year ending the 31st of March, 1901; also 100 LAMP COLUMNS and FRAMES.
Further Particulars and Forms of Tender may be obtained on application to the Engineer and Manager, Mr. Octavius Thomas, Gas and Water Offices, Pentre R.S.O., Glam.
No Form of Tender other than that issued by the Committee will be accepted.
Tenders, endorsed "Contract 1, 2, &c.," as the case may be, addressed to the Chairman of the Gas and Water Committee, to be sent to the undersigned on or before Ten a.m., Thursday, the 27th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
WALTER H. MORGAN,
Clerk.
Council Offices, Pentre R.S.O.,
Glam., Sept. 14, 1900.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GRANTON WORKS.

THE Commissioners are prepared to receive TENDERS for the construction of CARBONIZING PLANT upon the INCLINED RETORT PRINCIPLE, to the Design and Specification prepared by their Engineer.
Specification and Schedule of Quantities may be obtained upon a payment of Ten Guineas to Mr. W. R. Herring, Chief Engineer and Manager, New Street, Edinburgh; and detailed Drawings may be inspected at his Office by appointment any time on and after the 15th inst. The Ten Guineas will be returned on receipt of *bonâ-fide* Tenders.
Tenders will only be considered on the forms attached to the Specification and Schedule of Quantities, and must be delivered to the undersigned at or before Ten a.m., on the 8th of October, endorsed "Tender for Carbonizing Plant."
The Commissioners do not bind themselves to accept the lowest or any Offer.
JAMES M'G. JACK,
Clerk.
25, Waterloo Place, Edinburgh,
Sept. 11, 1900.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 4th of October, 1900, at Twelve o'clock at Noon, to receive the Report of the Directors, to declare a Dividend, and for other Business.
The STOCK TRANSFER BOOKS WILL BE CLOSED from the 21st of September inst. to the 4th of October next, both days inclusive.
By order of the Board,
H. D. ELLIS,
Secretary.
Offices: Stepney,
Sept. 12, 1900.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 26th inst., at Twelve o'clock precisely, to transact the usual Business, to declare a Dividend for the Half Year ended the 30th of June last, and to elect Two Directors and One Auditor in place of those who go out by rotation, but who are eligible for re-election.
Notice is Hereby also Given, that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 15th inst., and RE-OPENED on the 27th inst.
By order of the Court of Directors,
H. B. CHAMBERLAIN,
Secretary.
Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
Sept. 5, 1900.

CORPORATION OF BLACKPOOL.

THE Gas Committee are prepared to receive TENDERS for the surplus TAR produced at their Gas-Works during the next Twelve Months from the 30th of September, 1900.

Particulars from the undersigned.

Tenders to the Chairman by the 22nd inst.

JOHN CHEW,
Gas Engineer.

OTTOMAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held at 9, Queen Street Place, Cannon Street, E.C., on Tuesday, Sept. 25, 1900, at Half-past One o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare a Dividend, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from Sept. 18 to 25, both days inclusive.

By order of the Board,
THOMAS GUYATT,
Secretary.

9, Queen Street Place, Cannon Street,
London, E.C., Sept. 4, 1900.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ILFORD GAS COMPANY.

£7500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 9th of October, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 500 £10 NEW ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 9th of October, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— LIMITED, —

1, FENCHURCH AVENUE, LONDON, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

NITRATE of Thorium and Cerium.

FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND Co., HAMBURG.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the

WHESSOE-MUNICH BENZOL CARBURETTER

The Cheapest and Best in the Market.

The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.

Apply to the Sole Makers:
THE WHESSOE FOUNDRY COMPANY, LIMITED,
DARLINGTON.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.

Inquiries Solicited.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD.

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., Ld.,

CHESTERFIELD.

HARDMAN & HOLDEN, Ld.

ESTABLISHED 1820.

SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

Head Office: Miles Platting, MANCHESTER.

Inquiries Solicited.

LONDONDERRY GAS COALS

FROM THE

LONDONDERRY COLLIERIES,

COUNTY OF DURHAM.

Available Output up to 5000 Tons per day.

Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by

Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR,

COUNTY OF DURHAM.

HOLMSIDE GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,

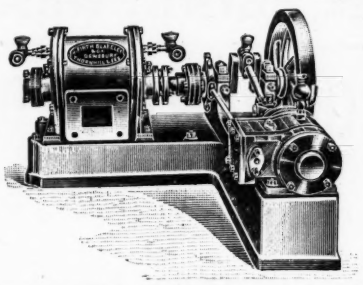
165, QUEEN VICTORIA STREET, E.C.;

And at STROUD, GLOUCESTERSHIRE.

J. Firth Blakeley & Co.,

Gas Engineers,

Thornhill, DEWSBURY.



The **High Prices of Coal** should induce Small Gas Authorities to adopt an Exhauster, and thus effect a large saving in Coal.

Probably at least 750 cubic feet more Gas being made from each Ton of Coal Carbonized.

Several Sets of **EXHAUSTING PLANT** in Stock, both New and Second-hand.

Particulars sent on application.

Thorough Efficiency Guaranteed.

Exhausters, any capacity.

NEW GAS PLANT OF ALL KINDS. RETORT WORK, CONDENSERS, WASHERS, SCRUBBERS, PURIFIERS, METERS, GOVERNORS, GASHOLDERS, VALVES, &c., IN STOCK OR PROGRESS.

Photos. sent. Inspection invited.

Telegrams: "BLAKELEY, THORNHILL LEES."

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

GAS-FITTINGS.

BURNERS

Welsbach Pattern

per 7/6 Doz.

WRITE FOR CATALOGUE.

WHOLESALE FITTINGS COMPANY

80, Commercial Road, London, E.

INCANDESCENT

BOLDON GAS COALS.

Yield of Gas per Ton.	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by

Mr. JOHN PATTINSON, F.I.C., F.C.S.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE, SON, & HUNTER,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

HARRIS & PEARSON,

STOURBRIDGE, ENGLAND,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

MOBBERLEY & PERRY STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES; BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

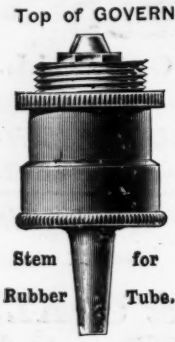
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

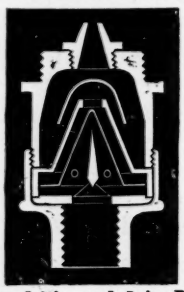
SPECIAL GOVERNOR FOR INCANDESCENT LIGHTING.

Top of GOVERNOR SCREWS Direct into Tube of BURNER, and is tapped to receive Incandescent Company's Nipple.



Stem Rubber for Tube.

Requires only $\frac{3}{10}$ths higher pressure than is necessary to pass the Gas through Nipple without a Governor.



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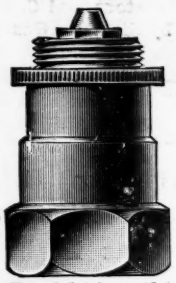

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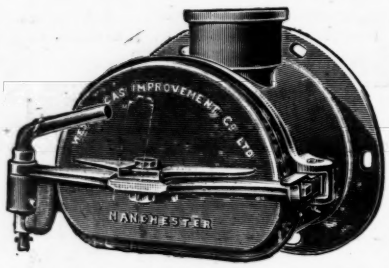

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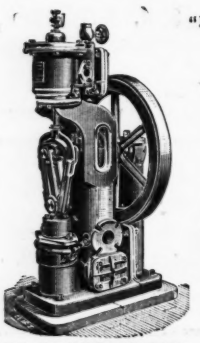

Fig. 705. "SINGLE RAM" STEAM-PUMP.

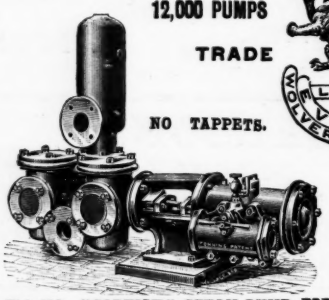

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

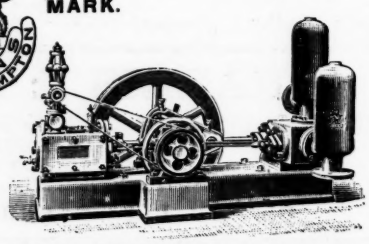

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

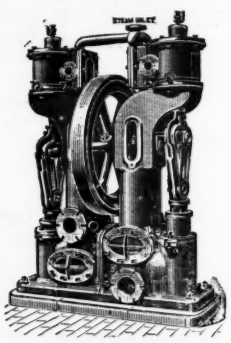

Fig. 719. "DOUBLE-RAM" STEAM-PUMP.

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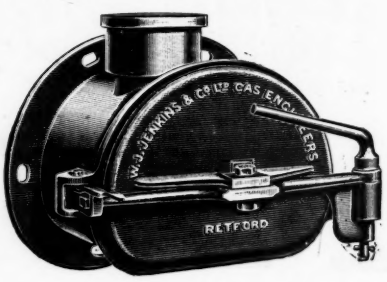

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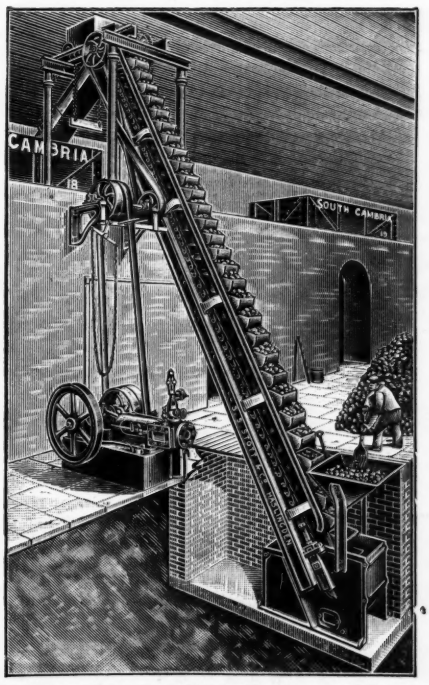

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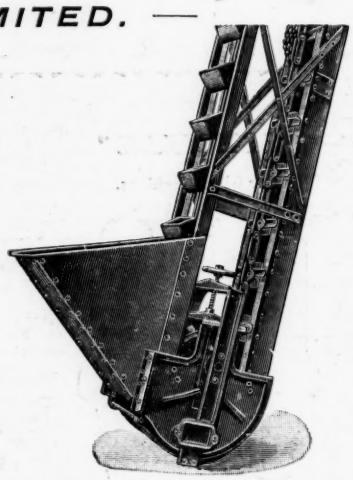

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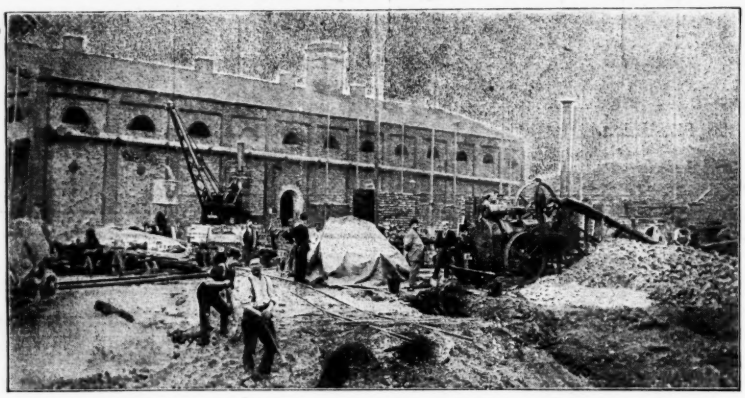

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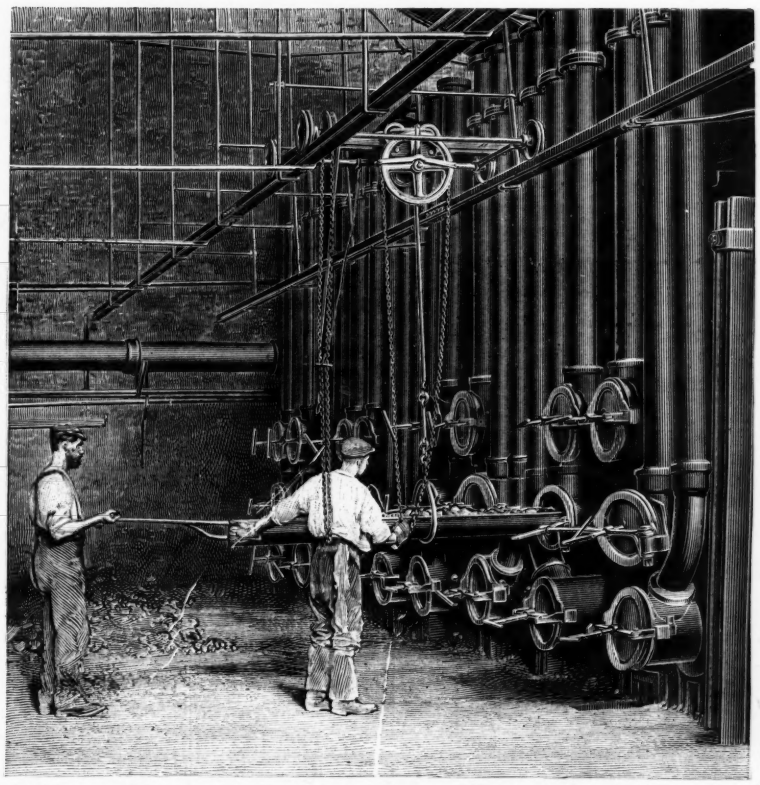

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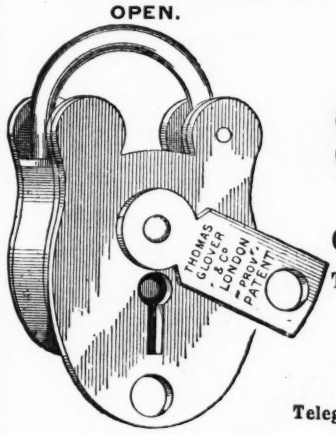

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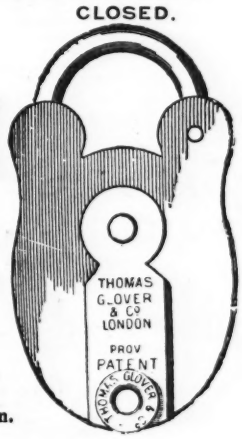

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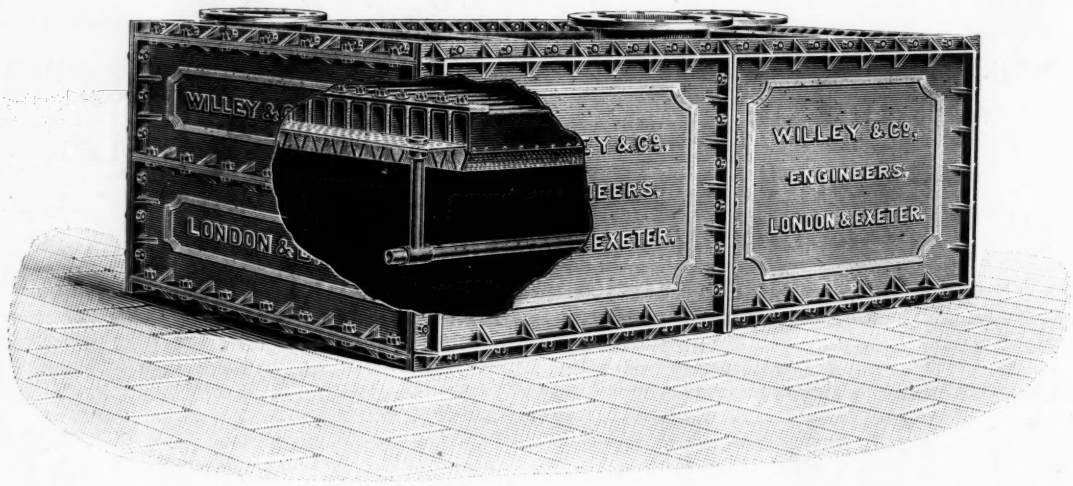

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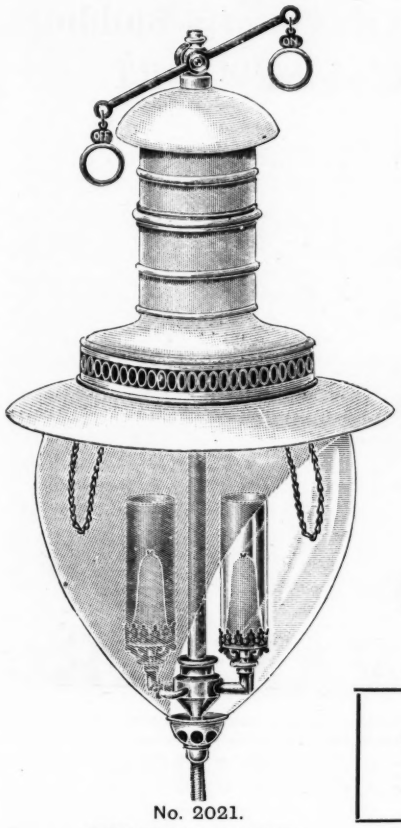

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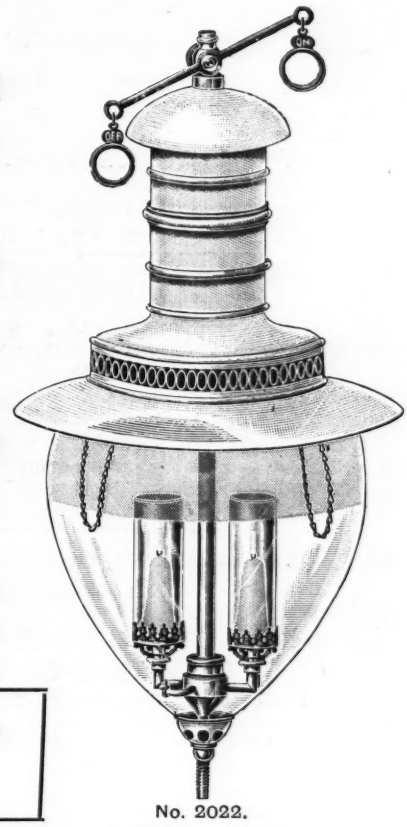

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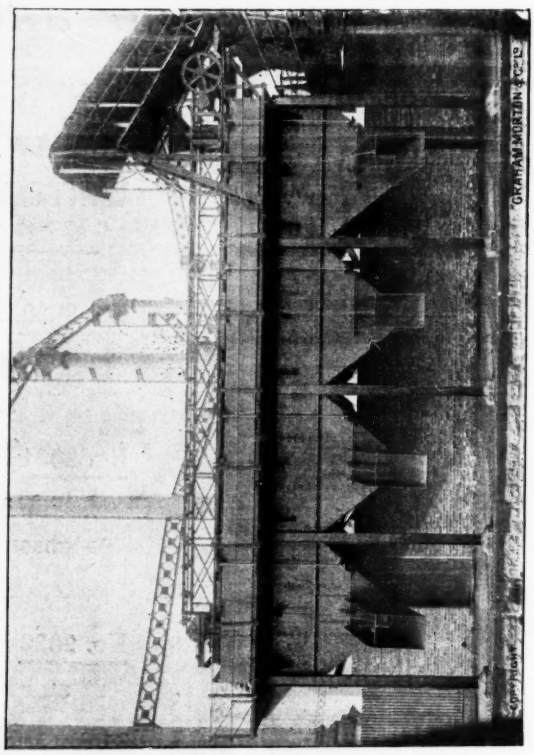

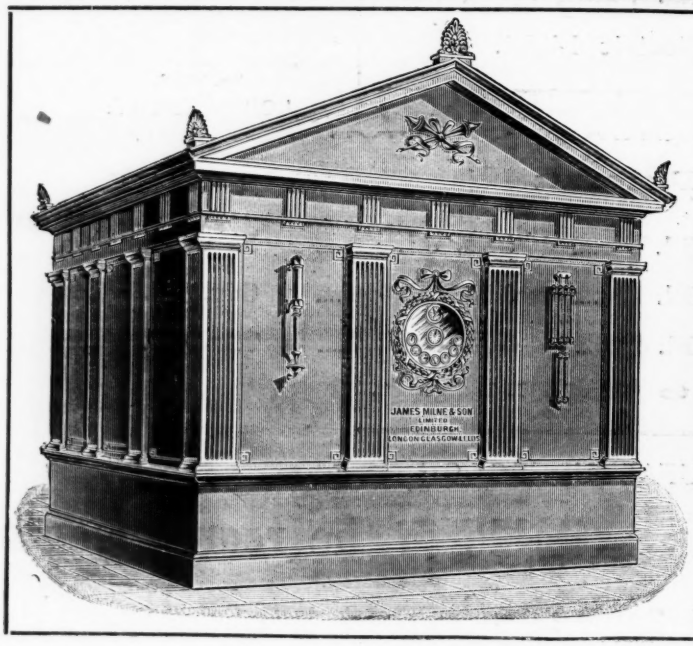

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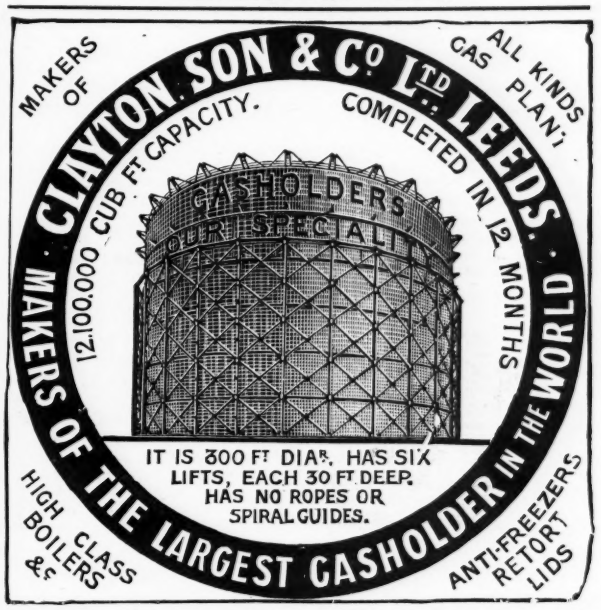
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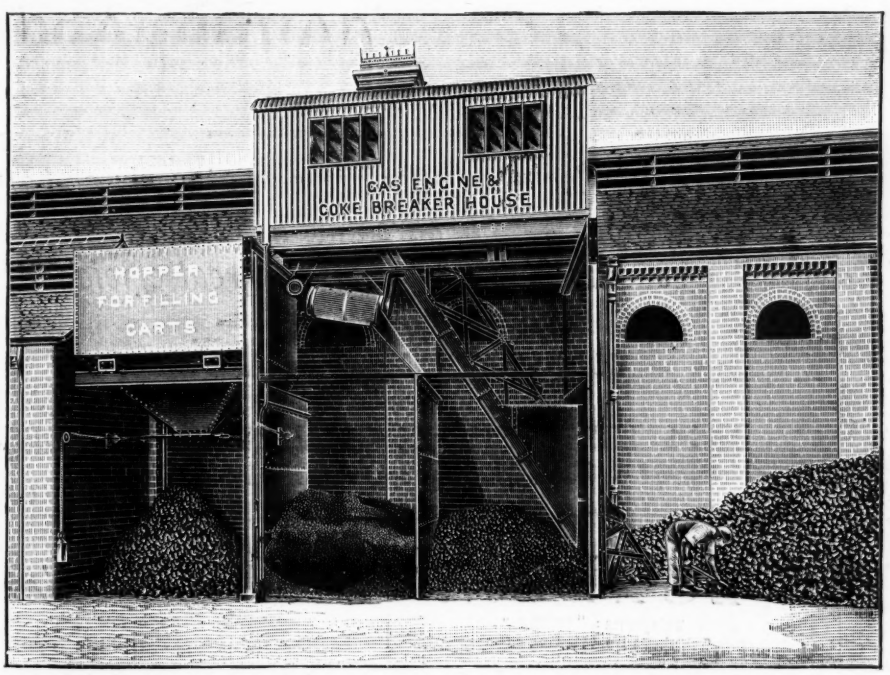

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[See also Advt. p. 684

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